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ABSTRACT

This interdisciplinary environmental education curriculum guide provides a series of environmental encounters for high school students. The purpose of the encounters is to develop an awareness and understanding of community environmental problems. The guide utilizes math, science and social studies in the study of urban environmental problems. Although the guide focuses on a specific community, the urban problems that are explored are common to most communities. The guide is divided into six cycles, each containing math, science and social studies activities. Each cycle is designed to be covered in seven days, the first six devoted to teaching and the seventh for testing. The cycles contain objectives and lessons which utilize math, science, and social studies; some cycles contain tests and bibliographical materials. The lessons reinforce the lesson objectives, and include completion time, equipment lists, location, and procedure. The lessons within the guide make use of such activities as mapping and measuring, discussion, and sample analysis. (TK)

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BROCKTON PUBLIC SCHOOLS

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PROJECT Q.U.E.S.T.

(QUALITY URBAN ENVIRONMENTAL STUDIES TRAINING)

AN ENVIRONMENTAL STUDIES CURRICULUM FOR HIGH SCHOOL

1974

SE 018 489

PROJECT QUEST

One of the most pressing problems of our time is the environmental deterioration of our cities and towns. The success our country will have in solving this problem will be determined, in large part, by the degree to which our people are enlightened regarding it. In order to raise the levels of awareness and responsiveness of the members of the Brockton community in relation to the environmental problems facing it, the Brockton Public School System, in cooperation with E.S.E.A. Title III, has established an interdisciplinary environmental studies course entitled Quality Urban Environmental Studies-Training Program. (QUEST). QUEST provides a series of environmental encounters for students so that they will enter the community cognizant of the environmental problems confronting their community.

The QUEST curriculum utilizes an interdisciplinary approach in the study of the complex environmental problems plaguing our urban areas. Since these problems arise from a multiplicity of causes, QUEST philosophy holds that they cannot be examined through any individual discipline. Therefore, the QUEST course structure consists of three disciplines; social science, science and mathematics. The majority of materials and case studies utilized in the course are drawn from community and regional resources.

The QUEST course is designed to be taught on a cycle basis. Each of the six cycles is seven days in duration, with the first six days devoted to teaching the materials and the seventh day for testing. The length of each cycle and the materials taught can be adjusted by the teachers as the need arises. The major focus of the course is the Brockton community. However, since most urban communities are afflicted with the same basic environmental problems it is a fairly easy task to adjust the course for any urban community.

MAURICE J. DONNELLY
DIRECTOR

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ENVIRONMENTAL

POLICY

Social Science - Cycle I

General Objectives: The students will begin to describe their urban environment as the resultant of historical, political, economic, cultural, planned and unplanned human forces.

Objectives:

1. After examining the concepts of ownership vs. stewardship, and the world views of man as separate from or one with his environment, students will describe their own attitudes toward the environment they experience in Brockton.

2. Students will complete an analysis of the services, needs, and land uses in their neighborhoods.

3. Students will compile a list of criteria for defining a neighborhood environment after comparing their perceptions of their neighborhoods with those of other students.

4. Students will be able to identify the local governmental structures and processes of land use decision-making which are reflected in the preparation and use of maps. They will match city government agencies with the description of their role in land-use decision-making.

Social science - introductory material

Lesson I: Attitudes and values towards land

Objective: After examining different attitudes towards environment (the concept of ownership vs. stewardship, and the world views of man as separate from or one with their environment) students will be able to write a brief essay explaining their attitudes as a source of environmental crisis.

Materials: handout of quotes selected from Western history and Indian history

extra credit (handout of Robert Frost's poems
(handout of Carl Sandburg's "Sodbuster"

Procedure:

1. Outline the major topics to be discussed during school year.

   a. relationship of economic systems to our urban environment

   b. relationship of our political and legal systems to our urban environment

   c. relationship of social problems - crime, drugs, housing, education - to urban situation

   d. social element of planning

2. Explain that before criticizing decisions other people and institutions have made about the environment, we should search our own attitudes. The attitudes and values we hold as Americans have been shaped through many influences on our culture. If we go back in history and examine some of these influences it may provide an insight into why we are faced with an environmental crisis today.

3. Pass out hand-out of "quotations on the land". Ask a student to read quote #1. Ask class to identify quote which is from Genesis. Ask another student to read quote #2. Question origin of quote - which some should be able to identify as an American Indian. Then ask students to compare these attitudes - how is the view expressed in #1 different from the view in #2. If students have difficulty articulating difference try symbols -

let ○ = environment

웃 = man

Where is "man" in relationship to environment in quote #1? in quote #2?

Answers most frequently given

#1 man is above, controlling, more powerful, larger, on top of, separate from

#2 man is within, smaller than, a part of

Point out that the new symbol being used to express what is man's relationship to environment should be in circle with man inside (Leonardo daVinci) - indicating man's power and impact on the environment, as well as his need to understand his position within it.

Continue reading - identify author - compare/contrast procedure with quotes #3 and #4.

Some points to emphasize:

White idea of <u>ownership</u> vs Indian idea of <u>stewardship</u>

Land as <u>reward</u> for <u>labor</u> and source of <u>profit</u> <u>vs</u> land as <u>gift</u> and source of <u>life</u>

Extra credit assignments:

Often the discussion of relationships between man and his world is dealt with through poetry. For extra credit give students a copy of Robert Frost poem and Carl Sandburg's prose - ask them to summarize the relationships these poets describe.

Cycle I

Lesson II: Urban environment - a neighborhood

Objective: After comparing perceptions of neighborhoods with perceptions of other classmates, students will prepare a list of criteria for defining a neighborhood analysis.

Materials: large newsprint paper
no. 2 pencils
signal dots - 4 colors
chalk
bulletin board space

Procedure: Acknowledge that lesson one is abstract - we seldom consciously consider our relationship to the "environment" as a whole, yet our behavior is affected by our unconscious perceptions and values. QUEST focuses on the urban environment of Brockton, which is what we experience every day. To understand our own relationships better, let's examine our ideas and experiences with our neighborhoods and ask how we perceive this part of our environment and what we value in it...

1. Pass out sheets of newsprint paper and pencils. Ask each student to draw on the paper their idea of what a neighborhood is, using their own neighborhood as an illustration. Explain only that whatever they think is important in a neighborhood should be included in drawing. (approximately 20 minutes) Ask them to write name - definition in words on back of paper.

2. When students have completed assignment, ask them to place a signal dot on a large map on the spot where their home is located; then draw a circle around the area they designated as their neighborhood. Distribute dots in four colors - according to East side, West side, North side, South side. The purpose of dotting and circling on map is to give students some idea of the different neighborhoods represented in QUEST classes. The division by East - West etc. can serve as basis for discussing the artificial social distinctions made in Brockton - how these developed - how valid they are. ("East side is tough;" "West is best" - etc.)

3. When all maps have been hung on board, ask students to observe differences and/or similarities in ideas expressed - what elements do all neighborhoods have in common? What are differences between people's ideas of what neighborhood is. (Some show people, cars - some bigger

area than others, land use differences). Make list of similarities. Then discuss reasons for differences. Try to arrive at a common definition - including physical, natural, and social aspects.

Extra credit assignment:

Ask students to find friends of same age or different ages living in same neighborhood (or same family).who will also draw "neighborhood". Have students compare maps and write brief ps agraph analyzing and explaining differences.

4. Read (or pass out in handout form) excerpts from writers discussing different aspects of neighborhoods to expand students' definitions.

ex. Jane Jacobs
or
Boston Globe articles which discuss effects of government decisions on quality of life in certain Boston neighborhoods

Assignment:

Pass out outline of a neighborhood analysis. The sample enclosed was prepared in part by students' suggestions - it could be improved upon - perhaps adding some questions on demography and architecture.

Idea for further development:

Photograph different neighborhoods of students to use later in year.

Analyzing an Environment: The Neighborhood

1. What is a "neighborhood"?

2. If you could choose any neighborhood to live in, what would you look for?

a. what physical things
b. what social things
c. what natural things

3. What human needs should be met in your neighborhood?

ex. human need	how met	who provides service?
a. a place to rest...		
b. a place for children to play		

c. someone to listen...

List at least 5 more human social needs and describe how they are met and by whom.

4. What kinds of goods and services are available in the stores and offices within your neighborhood?

	No.	
ex. drug store	1	(If you live in an all residential neighborhood, you may not be able to answer this.) (If these are not available in your neighborhood, list those services available within walking distance.)
gas station	3	
fast food	1	
ice rink	0	

5. What ward do you live in? _____
What school district? _____

6. Estimate the population in your neighborhood.
_____

7. Estimate the percentage of land in your neighborhood used for

a. single-family residences _____

b. multi-family residences _____

c. neighborhood commercial _____

d. shopping plazas _____

e. offices _____

f. industry _____

8. What changes have you seen in your neighborhood area?

9. Have you lived in Brockton all your life? If not, or if you have moved, how does your old neighborhood compare with your new one?

10. How do people affect your neighborhood?
How do you affect your neighborhood?
What does the word "community" mean to you?

11. How much time do you spend in your neighborhood?

12. What changes would you make in your neighborhood?

Cycle I

Lesson III

Objective: Students will be introduced to political perceptions of city through maps:

zoning map, ward-precinct map, assessors' maps

Students will be able to identify the local governmental structures and processes of land-use decision-making, which are reflected in the preparation and use of these maps.

Materials: zoning map
ward map
assessors plan map
overheads - population growth
purposes of zoning

Procedure: Using articles from Boston Globe or similar articles, emphasize the impact that governmental decision-making bodies have on the environment and therefore lives of people in the city.

1. Explain the ward-precinct system of representation on City Council and now on School Committee. Discuss the kinds of issues involved in different ward elections - development, streets, juvenile delinquency.

2. Point out that most of the issues discussed in ward campaigns are related to land use policy: examples: taxes, school busing, lack of open space. Introduce zoning by referring to the next map and explain that zoning is a technique of dividing land into certain use-districts in order to regulate development and to promote public good. Identify the use-districts types, and briefly describe the characteristics of each (refer to booklet: ZONING ORDINANCES OF BROCKTON). Raise question "why would people decide to do a thing like zoning?" Try to encourage responses that recognize zoning as a planning tool, a way of preventing overcrowding, insuring jobs, services etc. If few people respond, use overhead illustrating Brockton's population growth, and discuss the historic development of zoning around the 1900's when rapid industrial growth and urbanization plagued cities in Northeast.*

*As a supplement to this discussion you may wish to view the videotape of The City - a First Tuesday production. (V.T. #8B)

Using population growth overhead, have students identify the reasons behind the periods of rapid growth (1880-1920) and time of stabilization and decline (1920's - 1945). (This explanation was included in handout "History of Brockton" which students received during introduction to the course). Point out that today Brockton is one of the 25 fastest growing cities in the U. S. What has been attracting people here since 1950?

1880-1920 - shoe industry - jobs
progressive city

1920's-1945 - depression and war

1950's-1970's - building of residential areas
highway access to Boston and South Shore

First period of population growth was spontaneous, unplanned. It was not until 1900's that Americans first accepted idea that social planning was necessary and desirable. Before in keeping with concept of individual ownership and rights to land, it was seen as an infringement on individual. But by 1900 the problems created by social conditions of city were so overwhelming that people embraced planning and zoning as a solution.

Brockton established its first planning board in 1914. The role of the planning board then as now is to: (see overhead). Point to map prepared by planning board in 1914 and quote from Planning Report in 1915 and 1922 to illustrate situation then.

Using overhead on <u>purposes of zoning</u>, discuss the goals and assumptions of a well-functioning city. Use examples to explain purposes and abuses of zoning in past: e.g. "encourage best use of land" - this has meant <u>economic</u> best use, not environmental best use. Ex: Westgate Mall (refer to Enterprise article). "Protect value of land and buildings". Discuss snob zoning, which has had indirect effect on Brockton, since Brockton allowed low and moderate income housing.

*As supplementary assignment - give students copies of article OPEN SPACE AGE and ask them to answer questions. Discuss answers to questions next day in class.

Cycle I

Lesson IV

Objective: Students will match city government agencies with their role in land-use decision-making.

Materials: overheads on structure of City Government

Enterprise and Examiner articles as backup.

THIS IS BROCKTON - chapters 3,4 and 13

Procedure: Using overheads, outline the groups in city that are supposed to be planning the development of the city.

Taking each group in turn -

Planning Board
Zoning Board of Appeals
City Council
Mayor
Conservation Commission
Planning Department

Describe their role and give some anectodal background regarding their effectiveness (see articles). You may wish to assign chapters 3, 4 and 13 in the book This Is Brockton if enough books are available.

Supplementary exercise

Give students a list of types of problems that they and their neighbors might encumber. With the aid of telephone directories (especially Yellow Pages under GOVERNMENT section) have them identify the agency they would go to for assistance. At end of class, compare notes and clear up any confusion. This exercise proved helpful in making students aware of the many services available.

List the name and phone number of the community agency concerned with the problems listed below:

(use separate sheet of paper)

1. Your landlord has just raised the rent and you want to check if the increase is legal.
2. A friend suddenly chokes and seems to stop breathing.
3. You want to know who owns the vacant lot down the street.
4. Someone in your family is ill and medical bills need to be paid; money for food is tight.
5. You want to get your grandparents an apartment in one of the new elderly highrises.
6. You want to add a new room to your house.
7. You smell gas leaking in the air.
8. You see a power line dangling in the street.
9. Your tap water is rusty brown.
10. The drain in front of your home is overflowing.
11. You've seen rats in the basement of your apartment building.
12. You're with a friend who O.D.'s.
13. You need birth control and/or V.D. counseling.
14. You want help for your mentally retarded child.
15. You want to go back to work and need day care services for your children.
16. You're opening a new business and want some help in finding a good location for your store.
17. You want to use your house, in a residential area, as an office.
18. You want to register to vote.
19. You want to know who contributed to the mayoral campaign.
20. You want a map of the wards and precincts in Brockton.

21. You see someone dumping landfill into a swampy area.

22. You want to check on the legal boundaries of your property.

23. You want to learn who the past owners of your apartment building were.

24. You receive an excise tax bill for your car and think it is unfair.

25. You live near the urban renewal area and want to know the plans for your neighborhood.

QUEST SOCIAL SCIENCE QUIZ CYCLE I

1. Select the definition(s) below which best describe your own understanding of "neighborhood".

   A neighborhood is -

   a. a city or part of a city considered as a whole

   b. people living near you on your street or block

   c. unit for decision-making and planning

   d. people reaching and relating to one another in group or individual encounters

   e. place where a lifestyle is developed

   f. place where your friends and family are and where you can do things you like to do

   g. the physical area within close distance of your home

2. Briefly define your idea of <u>community</u>:

3. Match the city body below with its role in land use decision-making.

a. Building Inspector	1. conserves open land in city using authority of Inland Wetlands Protection Act
b. City Council	2. prepares a Master Plan of city's development needs and draws up zoning map
c. Conservation Commission	3. prepares ordinances, approves zoning changes, appropriates funds for land acquisition
d. Mayor	4. hears and decides cases of persons who have been refused building permits and grants variances
e. Planning Board	
f. Zoning Board of Appeals	

EXTRA CREDIT: Describe at least two differences in the way land is valued by Indian culture and our culture.

4. In the Boston Globe article describing the black/white conflicts in Boston that were touched off by the "torch murder" and the stoning and stabbing of an elderly man, one sociologist stated "the roughest confrontations occurred on the fringes where neighborhoods meet and where no one has a sense of who belongs there and who doesn't."

   a. Does your neighborhood provide this sense of security and trust for you? (Answer yes/no and explain briefly).

   b. List at least 3 ways this sense of trust can be built up or broken down.

5. What ward do you live in?

   If you were running for councilor on the city council, list at least two issues that are important to voters in your area.

6. List at least 3 purposes of zoning.

6. Match the following terms with proper description.

a. variance	1. the power to take private property for necessary public use at a just price
b. ordinance	
c. eminent domain	2. a city law
d. assessment	3. an exception to existing zoning laws
	4. process of determining tax on property based on market value of property

Background
Bibliography - This Is Brockton - League of Women Voters

Someone Is Stealing Your City - Zephyrius Publications, California

Principles & Practices of Urban Planning

by William Gordon & Eric Freund

Institute for Training in Municipal Administration

1968

Fragmentation in Land-Use Planning and Control

National Commission on Urban Problems

Research Report No. 18

People Before Property

A Real Estate Primer & Research Guide

Draft Edition

Community Research & Publications Group

Urban Planning Aid, Inc.

The Zoning Game

by Richard Babcock

University of Wisconsin Press

1966

In Defense of Property

by Gottfried Dietze

1963

The City in History

by Lewis Mumford

To Touch The Earth

The Life and Death of Great American Cities

by Jane Jacobs

MATH - SLIDES

Summative objectives for Cycle I

1. Students will put large or small numbers into scientific notation and vice versa.
2. Students will multiply and divide using scientific notation.
3. Students will read numbers on slide rule.
4. Students will multiply, divide, find squares and cubes, square roots and cube roots on slide rule.

Formative Objectives for Cycle I - Math

1. Student will change number in decimal form into scientific notation.
2. Student will change number in scientific notation into decimal form.
3. Student will multiply numbers in scientific notation.
4. Student will divide numbers in scientific notation.
5. Student will distinguish among primary, secondary, and tertiary gradations on a slide rule.
6. Student will read up to three digit numbers on the C-D on a slide rule.
7. Student will multiply on the C-D scale on the slide rule.
8. Student will divide on the C-D scale on the slide rule.
9. Student will find squares of numbers on the A scale on the slide rule.
10. Student will find cubes of numbers on the K scale on the slide rule.
11. Student will find $\sqrt{\ }$ of numbers on the slide rule.
12. Student will find $\sqrt[3]{\ }$ of numbers on the slide rule.

Title of Lesson: Use of practice in Scientific Notation as a Means of Interpreting Data

Objective: Given the directions on how to change larger and smaller numbers into scientific notation, the student will change any number found through experimentation, into scientific notation.

Time: 3 mods

Materials: Worksheet on scientific notation, blackboard and chalk, paper and pencils

Lesson IA

Procedure: Given 100, in powers of ten, name two other ways of writing it.

$100 = 10 \times 10^1$
$100 = 10 \times 10^2$

Try 500	50×10^1	5×10^2		
2,000	200×10^1	20×10^2	2×10^3	
35,000	$3{,}500 \times 10^1$	350×10^2	35×10^2	35×10^3
				3.5×10^4

$1=10^0$
$10=10^1$
$100=10^2$
$1000=10^3$
$10{,}000=10^4$
$100{,}000=10^5$
EXPONENT = # ZEROS

Scientific notation is a means of expressing a number using the powers of tens.

DIRECTIONS: Given 28,375 change into scientific notation

28,375. ← decimal point
$28{,}375. \times 10^0$

Move the decimal point to the left until there is only one units digit in front of it.

28375.

We had to move it 4 times and the power of 10 will be 4.

$2.8375 \times 10^4 = 28{,}375$

When you move the decimal point to the left, you raise ten to a positive power.

Now suppose you have a very small number:

.00614

and you wanted to change it to scientific notation

$.00614 \times 10^0$

This time we have to move the decimal point to the right so there is one units digit remaining in front of it.

$.00614 = 6.14 \times 10^{-3}$

When moving the decimal point to the right raise ten to a negative power.

DO WITH THEM:

Change into scientific notation:

1. 285,349
2. .000285
3. 42.16
4. .000000004216

Change out of scientific notation

1. 3.85×10^{-5}
2. 1.24×10^{3}
3. 6.97×10^{-2}
4. 2.38×10^{1}

When multiplying numbers alread in scientific notation. multiply the main digits and add the exponents.

$(5 \times 10^1) \times (6 \times 10^2) = (5 \times 6) + 10^{(1 \& 2)} + 30 \times 10^3$

You may want to change your answer into scientific notation.

$30 \times 10^3 = 3 \times 10^4$

DO WITH THEM:

1. $(3.1 \times 10^{-3}) \times (9 \times 10^1) = 18.9 \times 10^{-2} = 1.89 \times 10^{-1}$
2. $(2.7 \times 10^4) \times (5 \times 10^6) = 13.5 \times 10^{10} = 1.35 \times 10^{11}$
3. $(6.8 \times 10^{-2}) \times (2.2 \times 10^2) = 14.96 \times 10^0 = 1.496 \times 10^1$
4. $(.3 \times 10^{-5}) \times (.3 \times 10^{-2}) = .09 \times 10^{-7} = 9 \times 10^{-9}$
5. $(.025 \times 10^2) \times (1 \times 10^3) = .025 \times 10^5 = 2.5 \times 10^3$

When dividing numbers in scientific notation, divide the main digits and subtract the exponents.

$$\frac{(4.8 \times 10^{2})}{2 \times 10^{1}} = 2.4 \times 10^{1}$$

DO WITH THEM:

1. $\frac{1.5 \times 10^{3}}{5 \times 10^{1}} = .3 \times 10^{2} = 3 \times 10^{1}$
2. $\frac{7.26 \times 10^{4}}{12 \times 10^{1}} = .65 \times 10^{3} = 6.5 \times 10^{2}$
3. $\frac{2.25 \times 10^{3}}{1.5 \times 10^{-2}} = 1.5 \times 10^{5}$
4. $\frac{8.1 \times 10^{-4}}{.9 \times 10^{1}} = 9 \times 10^{-5}$
5. $\frac{.056 \times 10^{-10}}{.8 \times 10^{-12}} = \frac{5.6 \times 10^{-12}}{8 \times 10^{-13}} = .7 \times 10^{1} = 7$

(On practice sheet throw in some multiplication and division combinations.)

Title of Lesson: Introduction to the Reading of A Slide Rule

Objective: Given a representation of a slide rule, they will be able to read the primary and tertiary lines as numbers and differentiate between the scales.

Time: 3 mods

Materials: Overhead Projector and transparencies of a slide rule, copies of a slide rule representation, paper, pencils, rulers

Procedure: Display transparency of "Parts of Slide Rule" and slide rule. Compare parts of the representation and the instrument.

Move hairline across rule.

Distinguish among the A, B, C, and D scales. Will they notice that A and B and C and D are constructed the same?

Indicate that the movement of the B and C scale will be important for future reference.

Now notice that between the larger 1 and 2 on the C-D scales, this portion is broken down into smaller intervals - into tenths.

1. Four intervals after the primary 1 is a secondary 4 so this point reads 1.4.

1 | 11 12 13 14 15 16 17 18 19 | 2

2. Seven intervals read 1.7.

3. Ten intervlas read 2.0.

PRACTICE:

On the mimeographed copy of a slide rule find:

1. 1.3 3. 3.5 5. 2.6

2. 1.1 4. 6.2 6. 9.8

1 | 1 2 3 4 5 6 7 8 9 | 2

Interval between 1-2 on C-D scale on slide rule

Entire Slide Rule 1 2 3 4 5 6 7 8 9 10

The primary gradation is the first digit of any number while the secondary gradation is the second digit of any number.

Lesson IB

These numbers on the scale can be broken down even smaller into tertiary gradations. Tertiary gradations are the third digits of any number.

Looking at your paper, find 1.25.
Notice that even on the slide rule as you go to the right, the intervals become even smaller. In these cases many times you will have to approximate numbers.

The number 1.25 that you have just found may also represent 12.5, 125, 1250. In other words, the decimal point may be in any position depending on what the problem asks for or what you want it to be.

DO WITH THEM: Find: (N.B. there is more than one answer)

1. A 1.56, 15.6, 1565.)
2. B 2.36, 23.6, 2366.)
3. C 2.98, 29.8, 2987.)
4. D 3.9, 39, 390
E. 5.7, 57, 570
F. 7.25, 72.5, 725
G. 9.33, 93.3, 933

DO WITH THEM: Determine:

1. 1.78
2. 8.35
3. 40.8
4. 233
5. 84.5
6. 17.35

Title of Lesson: Learning how to Multiply and Divide on the Slide-Rule

Objective: Given a slide rule, representations of problems using the slide rule, the student will be able to solve problems of multiplication and division on the slide rule.

Time: 3-6 mods

Materials: A slide rule, paper, pencil, overhead, transparencies

Lesson IC

Procedure: In order to learn how to multiply and divide on the slide rule, we will work primarily with the C and D scales.

RULE: To multiply one number by another:

Set 1 of the C scale over one of the numbers you are multiplying on the D scale. Next find the other number you are multiplying on the C scale. Set the hairline over that factor. Read the number on the D scale that the hairline is over. That is your answer.

DO WITH THEM:

1. 2 x 3 = 6. Set 1 of the C scale over 2 on the D scale. Move the hairline to 3 on the C scale. Read what the hairline says on the D scale.

2. 15 x 5 = 75. Set 1 of the C scale over 1.5 (15) of the D scale. Move the hairline to 5 on the C scale. Read what the hairline says on the D scale.

3. 40 x 3 = 120. Set 1 of the C scale over 4 (40) of the D scale. Move the hairline to 3 on the C scale. Read what the hairline says on the D scale.

40 x 30 = 1200, 4 x 3 = 12, 400 x 3 = 1200, 400 x 300 = 120,000

N. B. decimal changes and additional zeroes

Have them practice on:

1. 2 x 4	5. 15 x 45	9. 5 x 4	13. 775 x 243
2. 15 x 4	6. 176 x 375	10. 7 x 7	14. 413 x 313
3. 25 x 3	7. 233 x 32	11. 57 x 34	
4. 12 x 4	8. 4 x 4	12. 41 x 9	

* 1. 14.7 x 3.76
2. 18 x 3.7
3. 280 x 0.34
4. 0.0215 x 3.54
5. 4.15 x 2.35

In multiplying numbers with decimal points, to check yourself, you might try approximating the numbers you are multiplying, multiply them and compare your answers.

i.e. 1. 14.7 x 3.76

14.7 is close to 15 as 3.76 is to 4

15 x 4 = 60

Division is the opposite of multiplication

RULE: Move the divisor on the C scale (the divisor is the bottom number of a fraction or the number outside the $\overline{}$ sign) over the dividend on the D scale (use the hairline to set this up). Now read on the D scale the number under 1 on the C scale -- this is your answer.

You may notice when you have the divisor and dividend set up properly on the C and D scales they resemble the inverse of the original fraction for division.

DO WITH THEM:

1. $6 \div 2 = 3$. First set it up as a fraction: $\frac{6}{2}$. Locate 2 on the C scale (divisor). Place this point over 6 on the D scale (dividend). Now locate 1 on the C scale and read below it on the D scale. This is your answer.

2. $4.5 \div .5 = 9$. Set up as fraction: $\frac{4.5}{.5}$ Locate .5 on C scale and place it over 4.5 on D. Look beneath the 1 on C at D and that's your answer.

1. $4 \div 2 =$
2. $40 \div 8$
3. $3.5 \div 7$
4. $153 \div 9$
5. $36.7 \div 2 = 18.35$
6. $53.5 \div 5.05 = 1.6$
7. Watch decimal points
8. $3.14 \div 6.45 = 4.93$
9. $3614 \div 23 = 158$
10. $72 \div 26 = 2.77$
11. $738 \div 6.2 = 190$
12. $1.3 \div 982 = .1324$

Have you noticed the 1 on the other side of the C scale???

13. $62.4 \div .707 = 88.3$
14. $786 \div .085 = 925$
15. TRY: $\frac{576 \times .398}{98.2}$ $\frac{2.37 \times 60.4}{5.42}$ $\frac{13.2 \times 42.5}{1.87}$

Title of Lesson: How to Find Square, Square Roots, Cube and Cube Roots

Objective: Given a slide rule, the student will determine squares and cubes of numbers and the inverse operations of finding square roots and cube roots

Time: 3-6 mods

Materials: A slide rule, pencil, paper and worksheet

Lesson ID

RULE: To find the square of a number, omit the sliding, middle part of the slide rule. Place the hairline on the number you are squaring on the D scale. Find the hairline on the A scale up above. This is your answer

SQUARE:
1. 3
2. 5
3. 6
4. 9
5. 1.5
6. 25
7. 37
8. .56
9. 1.83
10. 4.293

RULE: To find the cube of a number, again omit the sliding part of the slide rule. Place the hairline on the number you want to cube on the D scale. Find the hairline on the K scale (above the A scale.) This is your answer.

1. Take the numbers above and find their cubes.
2. Find the squares and cubes of the following numbers:

a. 1.2
b. 57
c. 4.13
d. 23.3
e. 9.85
f. 763

RULE: To find the square root of a number, the numbers on the A scale have their square roots on the D scale. Also numbers on the B scale have their square roots on the C scale. Place the hairline over the number you are looking for, the square root on either the A or B scale. Then proceed to either the D scale or C to find the square root.

A.D.
B.C. > good reminders

DO WITH THEM:

1. $\sqrt{4}$
2. $\sqrt{9}$
3. $\sqrt{49}$
4. $\sqrt{225}$
5. $\sqrt{400}$
6. $\sqrt{12}$
7. $\sqrt{16}$

If you have a number with a decimal point in it, move the decimal point two places at a time until there is only 1 or 2 digits to the left of the decimal point. Place the number in scientific notation and find the square root of the number as in the above procedure. If you have 1 digit remaining, find the square root on the left hand side of the A or B scale. If you have 2 digits remaining, find the square root on the right side of the A or B scale. Another way of remembering is that if you have an odd number of digits to the left of the decimal point, then use the left hand side of the A or B scale.

Find the square root of:

1. $\sqrt{363.8} \approx 19.2$

To change it to scientific notation move two places to left - have 1 digit left so use left side of slide rule.

$$\sqrt{363.8} = \sqrt{3.63 \times 10^2}$$

1.92×10^2 $\quad$ $1.92 \times 10 = 19.2$

2. $9741.6 \approx 98.6$

To change it to scientific notation move two places to left - you have two digits remaining so use the right side of the slide rule.

$$\sqrt{9741.6} = \sqrt{97.416 \times 10^2} \approx 9.86 \times 10^{\frac{2}{2}} = 9.86 \times 10 = 98.6$$

3. $\sqrt{.005678}$ easier to use scientific notation

$$\sqrt{.005678} = \sqrt{56.78 \times 10^{-4}} \approx 7.52 \times 10^{\frac{-4}{2}} = 7.52 \times 10^{-2} =$$

4. $\sqrt{\dfrac{.0752}{684.952}}$

5. $\sqrt{5.469 \times 10^{-6}}$

6. $\sqrt{.0007368}$

7. $\sqrt{8695.72}$

8. $\sqrt{8976300}$

9. $\sqrt{.01075}$

10. $\sqrt{22.014}$

RULE: To find the cube root of a number follow the same procedure as finding the square root but:

1. Use D scale and K scales
2. Move decimal point 3 places at a time instead of 2.
3. If there is 1 digit remaining to the left of the decimal point then use the first scale to the left on K.
4. If there are 2 digits remaining to the left of the decimal point, use the middle scale of K.
5. If there are 3 digits remaining to the left of the decimal point, use the right scale of K.
6. Divide exponent of 10 by 3.

DO WITH THEM:

1. $\sqrt[3]{8}$

2. $\sqrt[3]{64}$

3. $\sqrt[3]{125}$

4. $\sqrt[3]{1728}$ move decimal point to $\sqrt[3]{1.728 \times 10^{5}}$
   On left scale find $\sqrt[3]{1.2 \times 10^{\frac{5}{3}}} = 1.2 \times 10 = 12$

5. $\sqrt[3]{.0315}$ move decimal point to $\sqrt[3]{31.5 \times 10^{-2}}$
   On middle scale find $\sqrt[3]{} \approx 3.13 \times 10^{-\frac{2}{3}} = .313$

6. $\sqrt{815}$ Look at scale on right of K 9.33

PRACTICE:

1. $\sqrt[3]{315}$
2. $\sqrt[3]{.0215}$
3. $\sqrt[3]{7.94}$
4. $\sqrt[3]{236,780}$
5. $\sqrt[3]{6.12}$
6. $\sqrt[3]{.000094}$
7. $\sqrt[3]{71}$
8. $\sqrt[3]{1,350}$

PLANNING AND ENGINEERING SCIENCE

Engineering and Planning Science-Cycle I

General Objectives:

1) The student will be able to similate a set of given mapable units of aboitic, boitic and cutural systems data related to an area in his environment in a common draft-plan scale and base overlay form.

2) The student will become consciously less disorientated from the complete systems which make up his micro and macro environment.

Cycle I

Lesson I: Introduction to total-system "carto-graphics"

Time: 2-4 mods

Objectives:

1. Provided with a QUEST designed holographic grid the student will locate, upon said grid, the time, space, and strata focus of a series of abiotic, biotic and cultural components.

2. The student will discriminate between a set of local physical-natural and local physical-cultural cartographic features and delineate their respective boundaries in surrogate themeographic form.

3. The student will be able to categorize a series of "pure-natural", man-made and controlled, and man-modified systems.

4. Provided with a series of system diagrams with several blank spaces the student will correctly fill in the blanks.

Materials: Time - Space - Strata and A-biotic, biotic-cultural component and system overlays

Procedure:

1. Discuss the properties and conditions of materiel being, places upon spherical space, boundaries, systems, time, strata, energy, etc.

2. Show cartoon vignettes demonstrating the "eternal" problem of scaling and symbolizing environmental systems.

3. Demonstrate use of holograph as a tool to help eliminate the feeling of micro and macro system dis-orientation.

4. Exercise #1 - Students complete a set of questions re: holograph use and boundary terms.

5. Hand out homework reading necessary for preparation for Lesson II.

Pitfalls:

1. Many students are poorly prepared to deal with some of the abstract concepts in this lesson.

Suggestions for further development:

1. Create schimatic models as an aid in conveying concept perception.

2. Many students were fascinated by the brief discussion of such topics as:

a. Cultural territorialism and the inherent conflicts caused by the way social groups view the earth's resources
b. Globalism vs nationalism vs regionalism
c. Self-subsistant techniques and environments
d. Conflict between uses intrinsically, inplied within natural resource boundaries and those implied by population clusters.

All above are worthy of development

3. Adapt Roth systems to the T.E.TE system diagram and QUEST diagram

4. Further develop the material dealing with system cross connectors and related motion factors.

Lesson II: Environmental Engineering - Drawing - Map Lab

Time: 8-16 mods depending upon group competence

Equipment: See Field lab section (Lesson III)

Location: Drafting Room

Objectives:

1. Provided with various local and regional plan segments and a set of multi-increment engineer's scales, the student will measure the distance between the center of two features to the nearest respective increment and reproduce, in line form, on a second set of plans.

2. Provided with various local and regional plan segments, a T square, a 30, 60, 90 angle and an architect's compass, the student will determine the angular measurements between the centers of a series of features and a central "position" feature to within 3 minutes of arc and reproduce these, in line form, upon a second set of plans.

3. Provided with an expansion-reducer, a circular slide rule and a series of multi-scale images of a specific plan area and the scale for one of these respective images, the student will determine the correct scale for the entire set of images.

4. Provided with the raw angular, linear and horizontal control measurements of a sub environmental system contained within a major plan and the equipment mentioned in the above objectives, the student will identify said system, isolate it, reproduce it and expand it or reduce it according to the dimensions limitations of a set of multi-sized work-sheets.

5. The student will discriminate between and "isolate" physical-natural and physical-cultural map systems with 80% accuracy.

6. ....will identify and isolate local and regional map units with respect to given specific map positions with 80% accuracy.

7. ....will use the map key guide to identify an unknown map symbol with 80% accuracy.

8. Given a topographical map section and a QUEST 1:20,000 scale ruler the student will measure the distance between the center of two features to the nearest 100' increment with 80% accuracy.

9. Provided with a topo section and an angle meter, 60% of the students will determine the angular measurement from North that the center of one feature is respective to the center of a second feature.

10. Given a local topographical map section and the value in feet of each 1" linear section on the map, 70% of the students will accurately compute the "irregular line" distance between the centers of two features on the map.

11. Provided with the blank configurations of map features in and around Brockton, the student will name same with 90% accuracy.

Procedure:

1. Hand out all equipment at the beginning of each class and establish a firm system of sharing and returning said equipment to its source location.

2. Ask students to point toward the direction of the flagpole at the front of the school building.....toward East....toward city hall, etc. Discuss the reasons why students point to so many different directions.

3. Ask students how far it is, in feet, between the center of the school building and some other nearby building....discuss the concept of scale ....show vignettes regarding scale on overhead ....describe the use of the QUEST 1:20,000 ruler....measure between the <u>center</u> of city hall and the <u>center</u> of the local police station with the transparent map sections and the transparent QUEST ruler....stress the importance of the fine increment scale of the ruler and explain its proper usage....convert the 1:20000 units to 1"=1666'....demonstrate use of "milometer" in measuring irregular lines.

4. Using the angle meter, two 45° angles and the transparent map section, illustrate on the overhead the technique of aligning the angle meter center over the center of a map feature and aligning its arm in a true North South direction....demonstrate the "East or West of

north" or "clockwise from North" method of expressing angular measurement.

5. Demonstrate the "scale up" and "scale down" procedure.

6. After discussing the many approaches that could be taken to understand the local environment, explain the reasoning behind the QUEST problem approach....have students enumerate several of the 12 to 14 major problem areas that are common in all American cities....discuss the rationale behind studying a specific environmental system or area as means of gradually learning the complex art of environmental science....

7. Tell students to come dressed for a field lab tomorrow.
   (Note: (It is advisable to have taken students on a community awareness trip prior to above lesson.)

Pitfalls: Many students tend to require considerable individualized aid in working with the QUEST scale, etc. and in making mathematical computations necessary to isolate and portray essential abiotic, biotic and cultural micro systems within the region and community.

Students tend to require clear explanation at this point as to how the above relates to the next section on the water environment. Begin here to stress the "water geography" concept in order to provide for a smooth transition, i.e. "expanding learning model"

Cycle I

Lesson III: Place - Objects - Systems - Perception Graphics
Field Lab followed by inside lab

Time: 6-12 mods (minimum of two inside and two outside lab days)

Location: A. Any location on school grounds which provides a clear view of 180° of horizon and includes true North and its declination.

B. Map lab

Equipment: Transit level and Tripod, plane tables, architect's compass, drawing board, 18 x 22 worksheet, Brunton compass, 30, 60, 90 mile-meters, ceiling blocks, T squares, measuring tape, 1:20,000 and 1:24,000 scales, expander reducer scales, architect's angle, land use slides, local topographical map section transparencies, zipatone paper, drawing table machine and arms.

General Objective: Student will reproduce a set of planar horizon urban system criteria delineators observed in the field at a 1:80 scale.

Formative Objectives:

1. Taken to the roof top the student will use the necessary materials from the above test to isolate and portray upon polar coordinate paper, the previously defined urban system determiners built upon the horizon of the micro setting.

2. Taken to a second vantage point the student will perform the same exercise described above and produce a comparative data compilation which delineates 80% of the angular, linear, and structural component changes conditioned by the position perspective variant.

3. Provided with a series of system symbolics pertinent to place-boundary perception, the student will categorize them as being related to broad boundary development pragmatics.

4. Provided with a set of abiotic, biotic, and cultural symbols and three mismatched ground fields, the student

will organize same in the most efficient theme-communicator forms.

5. Provided with a Brunton Compass, a worksheet and a plane table the student will orient edge of compass with vertical edge of worksheet; rotate said sheet until its edge is pointing 15 degrees - 30 minutes to the East of magnetic North and draw a set of base lines.

6. Provided with a T square and an architect's angle, the student will construct North-South and East-West lines, the intersection of which will accurately represent the observer's position within the scaled field frame.

7. Using the T square the arthitect's scale and a vernier the student will determine the angular measurement between two urban system components which are within 60° of each other to within one minute of accuracy.

8. Using the Topographic map and the engineer's scale, the student will determine the distance between the position station and the two elements. identified in objective 3.

9. Using the correct trigonometric function the student will calculate the distance between the structures described in objective 3 <u>without</u> the use of the topo.

10. The student will know and use the latest modifications of standard technique which relate to economics in making and using drawings - simplified practices; use of templates and overlays, special use of reproduction, photo drawing, model making, illustrated drawing and the use of special methods and equipment.

11. Provided with a set of line drawings of isolated system components from a local holographic setting, the student will draft an orthographic composit of same.

12. Provided with a three view line or iconic image of a local construct, the student will draft an orthographic composit of same.

13. Provided with a three dimensional scaled cross sectional model of a local or regional graticule, the student will compose a three view orthographic instrument drawing with views correct and accurate within 1 mm.

14. Provided with an orthographic drawing, the student will construct a plan view in shaded line - pictorial form.

15. Provided with a down-view graticule pictorial, the student will identify planar essentia and create boundary and construct symbols for same.

16. Provided with a physical scale model of a cultural-natural setting, a vernier caliper, a Lietz compass and an engineer's scale, the student will record and compile the essential measurements pertinent to the object correctly within .001 of an inch.

17. Provided with a set of system mechanisms, the student will compile the complete set of necessary working drawings - both assemblies and details.

18. Given the slope % and the center to center distances of two surficial points, the student will construct a cross sectional scaled view of the contour profile of a pipe line.

19. Provided with orthographic drawings of classical environmental structure configurations and necessary instraments, the student will develop the lateral surfaces of said configurations so that when cut out they will form the correct shape.

20. Provided with necessary data, the student will construct piping scale layouts, diagramatic layouts and isometric layouts.

21. Provided with the necessary statistical data, the student will construct bar charts, pie charts, and rectilinear graphs for technical or popular presentation.

ENVIRONMENTAL ECONOMICS

Social Science - Cycle II

Summative Objective

1. Students will examine the concepts of our system of economic organization that need to be changed if our economy is to become an environmentally sound system. They will be able to interpret the social and political implications of two approaches to "environmental economics".

   a. that our system of free enterprise can be adjusted through taxation and technology to pay the environmental and social cost of pollution.

   b. that our system must be radically altered - our growth must be limited and our lifestyle changed.

Environmental Economics

Lesson I: Introduction

Objectives:

1. After discussing terms "economics" students will define economics to include idea that economics provides the system by which society chooses how to use and conserve its environmental resources.

2. Students will explain that an environmental economics system is one which provides for choices to be made on basis of environmental values.

3. After viewing slidetape "The Lorax" prepared from book by Dr. Seuss), students will summarize the criticisms made by the story of one over-consuming, overpolluting, overproducing economy.

4. After reading the book Everyman's Guide to Ecological Living (which proposes that our major problem is overconsumption), students will prepare a personal guide listing changes they'd be willing to make in their own habits of consumption and waste.

Materials: Visuals defining "ecology" and "economics" Slidetape (carousel projector, tape recorder) of The Lorax, chalkboard space, chalk, bulletin board space, copies of the book Everyman's Guide to Ecological Living

Procedure: Begin by writing the following definition on the board - ask students to identify word being defined.

> System by which individuals and societies choose to use limited resources (natural and human) to produce goods and services and distribute them for consumption, now and in future, among various peoples and groups in society.
>
> (If students have a hard time recognizing this as a definition of economics, then ask them what they usually think of when they think of economics -- money? inflation? energy crisis? unemployment?
>
> Try to explain the relationship of these economic experiences to the definition briefly or hold them until lesson two when our economic system will be explained in more detail.)

Go on to point out the relationship of the word "ecology" to "economics" - "both have the same root "ecos" meaning house and home, and both study the relationships of living and non-living things within that home. Economics judges the relationships in terms of their usefulness or desirableness to man; ecology studies the relationships in terms of their interrelatedness and impact on total life system.

"Over time, these two sciences have gone in different directions, to the point where economists have little if no understanding of environment, and visa versa. Our economic systems are not built on our understanding of the environment, and this is the source of our environmental crisis."

"There are many critics of our economy among environmentalists. The slidetape you are about to see presents the viewpoint of one of the most outspoken critics. Pay careful attention to the criticisms made."

Begin the slidetape The Lorax (about 15 minutes in length). (Note: preview slidetape in advance using book. There are no signals when to turn slide.)

When completed, ask students to comment on what Dr. Seuss was criticizing in our economy. If comments are slow, ask some of these lead questions:

Who was the villain?
Why was he called the ONCE-LER?
Who did the Lorax represent?
What is a THNEED?

Here ask students to bring in clippings from magazine and newspaper ads that illustrate THNEEDS to them. Some samples are enclosed.

What is the SUPER-AX-HACKER an example of?
(technological efficiency)

When discussion of THE LORAX exhausts itself, try to summarize - the villain was the THE ONCE-LER, the business-man who had to keep Biggering and Biggering and Biggering. Point out that there are other arguments too. Pass out book - Everyman's Guide to Ecological Living. (Make sure each student signs a list

with his name, the number of the book he has, and his homeroom number). Have students turn to introduction and read aloud together. Emphasize the point of view that "CONSUMPTION" is the problem, not production or producers. PEOPLE POLLUTE - and people must change their values and habits as consumers."

Explain assignment: Each student is to read the book and keep a list of those suggestions for changes that he or she is willing to do. The length of the lists will vary - the purpose is for each of you to consider these suggestions seriously and honestly assess the changes you'd be willing to make.

Assignments for Honors and Advanced students: Read and summarize the article What Ecologists Can Teach the Economists in the December 10, 1970 issue of the New York Times Magazine.

Lesson II: Environmental Economics
Failures of Our Market Economy

Objectives: Students will be able to identify the major weaknesses in our economic system which have resulted in mismanagement of our environmental resources, and suggest how changes can be made in system: These weaknesses are

a. the belief that the public interest will be served through pursuit of individual profit

b. the belief that the pricing mechanism would adjust itself to insure best allocation of resources

c. the belief that the production sector is responsive to the vote of the consumer in the marketplace

Materials: overheads
overhead projector
paper and pencils for students

Procedure: Return to definition of economics: "system by which individuals and society make choices - "how to use limited resources for the production of goods and services for consumption" and how to distribute these goods and services now and in future within society".

Our economic system was built upon the belief that the individuals within society should be free to make these economic decisions. Such a system is referred to as a "market economy". The theory of how a market economy should work was first written about by Adam Smith in his book The Wealth of Nations. Basically, the decision as to what goods and services should be produced was to be made in the marketplace through a balance of the forces of supply and demand.

Use overhead A to illustrate principles of market economy:

1. All participants in economy are divided into those who produce and those who consume goods and services. All participants are motivated by their own self-interest, but in the end, the interests of all will be best served by each individual pursuing his own gain.

2. The decision of what goods and services to produce will be made through interaction of consumer demand and ability of producers to supply goods or services.

3. Competition among the producers insures the most efficient process of production, resulting in best price for consumer. The producers that are able to satisfy demand will profit; those who are unable to respond to demand will lose out.

4. The value of goods and services produced is reflected in the price. Prices will adjust to changes in supply and demand and thus indicate the best use of resources.

Let's stop here and examine the environmental consequences of these assumptions.

Describe the conditions under which the original concepts of a market economy developed.

Using overhead of Adam Smith's statement of motivation of the system, explain how "the interests of society" were to be more effectually promoted" through pursuit of individual interest. Using some visual shots of pollution and environmental deterioration, urban decay, poverty, question whether this proved to be true. (This visual presentation needs further development.)

Tell the story of "the tragedy of the commons" (or perhaps stage it somehow) and ask students to draw parallels with environmental situation.

TRAGEDY OF COMMONS

Problems:

1. The belief that "by pursuing his own interest" each individual "frequently promotes (the interest) of society more effectually than when he really intends to promote it" has turned out to be wrong. This is illustrated by the following story:

   In days gone by, there was a common grazing pasture in the village. Each of the herdsmen in the village would bring their cattle there to graze. There was no system to control the number of cattle brought to the pasture, so each herdsman brought as many cattle as he could since he would be loosing out by keeping his cattle off the common pasture. Naturally, this led to overgrazing and eventually the pasture was ruined and the cattle went hungry.

   The tragedy of this story, and of our economy, is that individual herdsmen were locked into a system in which their individual self-interest

motivated them to take actions that were disasterous to all. The environment is the modern equivalent of the commons. Pollution is overgrazing our environment.

2. The choice of what goods and services are to be produced is supposed to be made in the marketplace through "the vote" or demand of the consumer and

3. competition keeps producers responsive to consumers.

Discuss the power and control large corporations have over the economy. For example, the automobile and oil industry, while responsible for 60% of air pollution and significant contributor to the energy crisis, are now multinational in scope, have more political influence than government regulatory agencies. (See folder on corporate capitalism for data, overheads and references to use in this section.)

It is a good idea to schedule one of the Nader videotapes - THE POWER TO POLLUTE (or JUSTICE FOR SOME) - following this discussion.

A discussion of "responsible industry" should be part of this section too. The speech by the president of the American Can Corporation - the Corporate Challenges - provides good insight into the way corporations view their role as "citizens".

4. Discussion of the price mechanism's inability to regulate efficient use of our resources should include reference to the following points:

   a. because "pollution" is efficient and, until the past few years "free" the price mechanism in fact encouraged continued pollution. (See THE CLOSING CIRCLE by Barry Commoner.) (Chapter 12)

   b. If the true environmental costs of production are to be included in the price, the results would mean upheaval in our marketing systems. (See overhead 2.) As illustrated in overhead "B", production affects the environment through depletion of resources, through processing, through waste in packaging, through disposal. (This is all discussed in book Everyman's Guide which students are reading.)

Other costs are discussed in the 4th Annual Report of the Council on Environmental Quality. It is difficult to predict what economic adjustments would be needed. In the 3rd annual C.E.Q. Report - the microeconomic impact on seven selected industries were predicted. These might be discussed in class (overheads) - together with changes that will inevitably be made necessary by the energy crisis. (See article "Running Out of Everything" which can be read and discussed in class to illustrate this.)

Material for preparing an optimal lesson on "the energy crisis" in terms of its being a product of corporate manipulation is included in packet on ENERGY CRISIS.

Lesson III: Limiting Growth: the case for a no-growth or stable-state economy

(note: The optional lesson on the energy crisis should precede this lesson.)

Objectives: After reviewing data abstracted from the book LIMITS TO GROWTH and other sources, students will be able to recognize the arguments supporting the case for replacing our economic growth model with a no-growth (or "stable-state" or "equilibrium") model.

Students will recognize that the American standard of living requires disproportionate share of the world's wealth and will discuss the questions of redistribution of wealth raised by the prospect of a stable economic situation.

Materials: Overheads from the book LIMITS TO GROWTH which document the limits to environmental resources being approached as result of industrial growth, which predict collapse of world social and economic conditions if present economic trends continue, and which illustrate the disproportionate use of resources by industrialized nations.

Overheads outlining the type of socio-economic changes required by a stable-state economy.

Procedure: Ask students to remember back to Dr. Seuss' criticism of the Oncler - the need to Bigger - Bigger - Bigger. Q. What was the result of his expansion? A. Depletion of tuffula trees. Ask why is it necessary to keep biggering in our economy? A. Explain the cycle of capital investment and profit-making that the economy depends on.

Point out that this fifth assumption of our economy "That Progress is Inevitable and Necessary" is indicated by the way we measure our economic "health". Ask someone to define GNP: the sum of goods and services produced by the economy (measured by personal consumption expenditure, government expenditure and investment expenditure). Using overheads, illustrate the exponential growth rates of economics in industrialized countries. Show the estimated reserves of materials left at present growth rates. Explain the results of predictions in the Club of Rome Study from the Limits to Growth. (It would be preferable to work out a system of overlaying the graphs so students could try to reason out the errors-impacts of exponential population growth and industrialization, limited agricultural

output, resource depletion and pollution.) Then outline the alternative - an economy where production = consumption, and where population growth is also stabilized. The "stabilized world model" in Limits to Growth illustrates corrallary decisions that would have to be made globally:

a. population growth must stabilize

b. industrial growth must stabilize

c. technologies for recycling resources must be developed

d. capital should be reinvested in agriculture, health services, etc.

e. pollution controls must be imposed and enforced

Use overheads which discuss the changes in employment and income distribution, which a stabilized economy would require. *(See article by H. Daly)

Discuss what leadership responsibility the United States should assume in moving towards these goals. In order to establish a common base for discussing this - pass out copies of the scenario: "An Image of America". (Note: This scenario could be updated by including figures on energy consumption, for example). If time permits, the issue of world "development" could be discussed at this point - an article on DEVELOPMENT by Robert Hunter discusses the problems encountered by "underdeveloped" nations in pursuing the model of U. S. development. This article might also be assigned to HONORS and advanced students.

For Further Reference: What Is Development?

Article by Robert Hunter - Overseas Development
1717 Mass. Ave., N.W.
#501/Washington D.C.20036

Toward a New Economics: QUESTIONING GROWTH

By Herman Daly in 2PG National Reporter
March 1971 Vol. 3, No. 3

Also in PATIENT EARTH, Holt, Rhinehart, Winston - 1971

LIMITED GROWTH as speech by John Bunting in VITAL SPEECHES (1972)

AN IMAGE OF AMERICA

If all the people in the world could be reduced proportionally into a theoretical town of 1,000 people, the picture would look something like this:

In this town there would be 60 Americans, with the remainder of the world represented by 940 persons. This is the proportion of the U. S. population to the population of the rest of the world, 60 to 940. The 60 Americans would have half the income of the entire town with the other 940 dividing the other half. About 350 of these would be practicing Communists, and 370 others would be under communistic domination. White people would total 303, with the 697 others being non-white. The 60 Americans would have 15 times as many possessions per person as the rest of the world. The Americans would produce 60% of the town's food supply although they eat 72% above the maximum food requirements. They would either eat most of what they grow or store it for their own future use at enormous cost. Since most of the 940 non-Americans would be hungry most of the time, it would create ill feelings toward the 60 Americans who would appear to be enormously rich and fed to the point of sheer disbelief by the great majority of the townspeople. The Americans would also have a disproportionate share of the electric power, fuel, steel, and general equipment. Of the 940 non-Americans, 200 would have malaria, cholera, typhus, and malnutrition. None of the 60 Americans would get these diseases or probably ever be worried about them.

Ideas for further development:

A. In explaining the concept of "externalities" which is done in the formative objectives in Lesson II, it might be helpful to use the term "bads" and Dis-services" in contrast to "goods and services". As Boulding says, "we pay people for the goods they produce, but do not make them pay for the bads".

B. The "Earth'keeping" series produced by WTTW/Chicago deals with the question of environmental/economic conflict in a much more entertaining way than these lessons. I would recommend ordering the videotapes to supplement -or substitute - for these lessons. A program synopsis can be obtained from PTST, 100 North LaSalle Street, Chicago, Illinois 60602.

C. Use book Environmental Handbook as reference. (Ballantine Co.,, 1970, ed. by Garrett DeBell)
Economics of Coming Spaceship Earth by Kenneth Boulding, p. 96
Tragedy of Commons, Garret Harden, p. 31

MATH

INTRODUCTION TO STATISTICS

Math - Cycle II

Summative Objectives: Given a brief introduction into statistics, including the jobs of a statistician, definitions of different kinds of samples, population and survey, the student will draw the appropriate pictorial representations of the data he will be given to work with.

Given the proper review of the different kinds of graphs and the means to find percentage, the student will be able to interpret and explain graphs.

Lesson I - Cycle II

Lesson title: Introduction to Statistics

Objective: The student will be introduced to statistics.

Time: 2 mods

Materials:

1. How to Lie with Statistics by Huff
2. Patterns in the Sand by Bostick and Caule

filmstrip projector and strip "Graphic Presentation"

record player

Procedures:

1. Explain to students the reason for using statistics: when dealing with environmental problems and you want to make a point in some direction, for example some water is polluted, no one will believe you unless you have facts and figures to back you up - henceforth statistics.
2. Show film strip - "Graphic Presentation - Part I"
3. Discuss points of film
4. Definition of population
5. Definition of sample
6. Definition of random sample
7. Definition of stratified sample
8. Definition of biased sample

Assignment: Read How to Lie with Statistics - Introduction and Chapter I

Patterns in the Sand p. 208-212

Lesson II

Lesson title: "Statisticians' Jobs"

Objectives: 1. The student will be able to discriminate as to what is a valid random sample and what is a biased one.

2. The student will be able to organize data into a frequency table.

Time: 2 mods

Materials: Overhead of blank frequency table, overhead of grouped frequency table

Procedures: 1. Review reading from previous assignment:

"Message" in the Introduction of How to Lie - people use averages, relationships, trends, and graphs are not always what they seem - there is more in them than meets the eye. The book's purpose is to help the honest man learn his defense, the crooks already know the tricks.

"Message" of Chapter One: A sample must be representative and even if you can't see where it could be biased, you should still be a little skeptical about what you read. Go over examples in chapter and why are they biased.

Note: It is not necessary to rig a poll or twist the results in order to create a false impression - the tendency of the sample to be biased in a consistent direction can rig it automatically.

Example: You want to have Field Park abolished - so you take a survey to see how many people use the park - you want a result of not many so you sample people on the south and east side of town who have little or no transportation to get there. Biased sample gives biased results; however, the statistics based on the sample did show that only 1% (for example) used the park each month.

Introduce 4 jobs of Statistician

1. collect data

2. organize it

3. analyze it

4. make conclusions

Taking samples or surveys whether or not they are water samples, population studies, anything - any data collected is the first job and you must be careful that it is an unbiased sample.

Our next step is to organize it.

Use 30 scores of baseball team - overhead - by just listing the scores they don't really say anything. Remember the purpose to statistics is to make a point or argument. Can you get a quick idea of what is happening with this team? Maybe we can organize it somehow.

Fill in frequency table. Have the students talk about which score occurred most often; around which scores does the greatest distribution fall?

Introduce idea of grouped data (overhead); explain how it is not always necessary to know how often each individual score occurred - need only know how a group of scores happened. Example: How many students received scores in the 70-80 (C) range?

Assignment: Find an ad or article in the newspaper or a magazine which states the results of some statistics - have the students look for some bias in the sample.

Lesson III

Lesson title: Percents

*(at end) Objectives

Time: 2 mods

Materials: Newspaper articles from homework assignment. Be sure to bring in a few of your own as students tend to forget them also, for this lesson you need one which reports percents. Overhead of frequency table (filled in).

Procedure: Go over homework for bias. Point out per cents used in articles. Go on to dealing with varied percents.

1. Show overhead of frequency table. The team made a score of 4 most of the time - what percent of the games did the team make a score of 4?

   6/30 = 1/5 20/100 - 20%

   What percent of the games did they score less than 4?

   12/30 ≡ 2/5 40/100 = 40%

   Have the student work on % of taxes used for education, parks and recreation, etc. Have them work on % of population of ages, schools, minorities, etc. Have them find % of housing units owned, rented, etc.

   Perhaps the articles can give further examples of use.

2. Use the articles to point out places where they mention percents - what do these mean?

   If 25% - means 1/4 or 1 out of very 4, what about 35%?

   35% = 35/100 = 7/20

   $37\frac{1}{2}\% = \frac{37\frac{1}{2}\ (2)\quad 75}{=200} = \frac{3}{8}$

   Find figures for water supply. Example: Stoughton uses ____% of the water pumped - work backwards on the taxes, population, etc.

3. Use an article where they mention the percent and the total. How many are they talking about?

50% of 150= ?

$\frac{50}{100} \times \frac{150}{1} = \frac{7500}{100} = 75$ or

150 X .50

40% of 60

$\frac{40}{100} \times \frac{60}{1} = \frac{2400}{100} = 24$ or

60 X .40

Assignment: Read p. 37-44 in How To Lie - write brief paragraph to summarize "message".

Pitfalls: The news articles can often be difficult and time consuming to find and as already stated the students often forget to bring them in.

*Objectives:

1. The student will determine percentages of data.
2. The student will determine the exact amount of a percentaged amount.
3. The student will reduce a percent to a lowest common ratio.

Lesson IV

Lesson title: Frequency Graphs

Objectives:

1. The student will form a circle graph given the data.
2. The student will form a bar graph or histogram given the data.
3. The student will work with tax, unemployment, income and crime data.
4. The student will interpret a circle and bar graph.

Time: 2-3 mods

Materials: Overheads - grouped frequency table, bar graph, unemployment and population growth, 2 histograms, frequency table and histogram of college freshman scores.

Procedures: Yesterday the students worked with percents; now use this information for circle graph.

Start with grouped frequency table - work out percentages and use blackboard and draw on approximate graph.

Now use an overhead (to be made) of a circle graph showing how the taxes for the city of Brockton are split into various areas. Discuss the breakdown - for example, 25% = 1/4 or one-fourth of the taxes go to one area. Have the students do one and interpret for environmental finances.

Remember to emphasize the fact that a circle graph splits up a whole when you know what all the elements are.

Sometimes you don't know what all the elements are, only some, and you want to show these.

Remind students that the purpose of using a graph is to tell a quick story - people very seldom or never will read a set of numbers, some will read a paragraph on these numbers - most will look at a graph.

Another type of distribution graph used is one showing bars of various heights representing various amounts.

For example (use overhead of bar graph) if we had a frequency table of the following scores - explain how to form graph - all bars equal with and not touching.

Show overhead of unemployment and population growth for further examples.

Introduce histogram - same principle only bars touch - show overhead - what if one score didn't occur - leave open space - show overhead.

If all these graphs follow from a frequency table, what do you do for a frequency table of grouped data.

Use college freshman score frequency table overhead.

Decide what you want for an interval midpoint, then find the start and end of each bar. Going by these intervals fill in the frequencies and make the histogram.

Pitfalls: The students <u>hate</u> making histograms for grouped data.

Areas for further development:

histograms for environmental areas
for example: do an analysis of soil to be picked up upon in Unit IV Science where gravel is 2 mm diameter
sand - 2 mm but $\geq$ 1/16 mm
silt - 1/16 mm but $\geq$ 1/256 mm
clay - 1/256 mm

See "gram analysis from measurement on a photo graph" in Section 4 Environmental Engineering backup materials.

Assignment: Histogram assignment sheet

Homework: Name_____

Make a frequency table and a histogram of the following coliform counts. Use back if necessary.

41, 37, 68, 63, 86, 74, 81, 93, 56, 47, 58, 56, 74, 68,

91, 92, 38, 47, 56, 56, 47, 41, 56, 47, 31, 37, 41, 47,

56, 68, 74, 68, 31, 48, 47, 56, 91, 38, 48, 47, 31.

Lesson V

Lesson title: Drawing Graphs

Objectives: Given sets of data the student will be able to form a line graph being sure to include all the basic fundamentals of graphing.

The student will discriminate when to use a line, multi-line, bar or circle graph given various sets of data and an "idea to picture".

Time: 2 mods

Materials: overheads: histogram, Brockton population, crime data

Procedure: Look at histogram on p. 221 in Patterns in the Sand. Ask the kids what it is telling you by the bar over the one. (4 families have one boy) - What is the bar over the 2 say? (12 families have 2 boys.)

What is the relationship between bar 1 and bar 2 - #2 has more. Pick up on comparison idea. Bar graph is used for comparison.*

Review for a second - what was a circle graph used for? To show the distribution of a whole.

Take an overhead of a histogram and sketch the interval midpoints to get a line graph. Point out how a line going up indicates increase and a line slanting down indicates decrease.

Therefore a line graph is for showing increase and decrease.

Use overhead of Brockton population. Show increases and decreases, point out largest increase or decrease found by degree of slant of line. (also perhaps use per capita water consumption trends)

Show crime delinquency figures and have the student make a line graph. Explain the component that is always increasing goes along the bottom, the one that goes up or down is the vertical axis. Make sure they label the axis and perhaps title the graph.

*Show overhead of comparing delinquency in 1963 and 1968 - 1968 has more.

One last graph is a multiline graph used to show comparison of increase and decrease over a constant period. Show graph of water consumption for Brockton and filtration plant area. Explain how graph shows comparison.

Pitfalls: Time may be a problem. There is a lot of concept material to be covered; therefore, the graphs and their implication material are not done justice time wise.

Areas for further development:

Perhaps work up a graph or have the students do it comparing the amount of water pumped from the filtration plant and the amount of water pumped into the sewerage plant. Perhaps a third line could be the amount of rainfall to help explain any discrepancies. Some data following.

Or perhaps do the following exercise on the sewerage plant.

Flows in sewerage plant

1971-1972

Month	Total	Avg.	Max. day	Min. day
	(mil. gal.)			
January	319.54	10.3	13.0	8.7
February	353.34	12.6	15.9	8.9
March	451.42	14.5	19.2	11.1
April	337.52	11.2	14.6	9.2
May	332.12	10.7	13.2	8.9
June	252.03	8.4	9.9	6.9
July	211.19	6.8	7.8	6.0
August	207.64	6.7	7.6	5.8
September	199.46	6.7	7.2	6.1
October	210.50	6.8	7.7	6.0
November	244.72	8.2	12.8	7.0
December	319.14	10.3	12.0	9.0
	3438.62	9.6	11.7	7.8
1972				
January	354.38	11.4	13.0	9.5
February	315.37	10.9	14.9	9.6
March	634.60	13.5	22.5	11.5

Lesson VI

Lesson title: "Limits to Growth"

Objectives: Using the graphs found in the book "Limits to Growth", the student will be able to state and understand the basic premise of the book.

Time: 2-3 mods

Materials: overheads: multibar graph comparing protein and calorie count/day of different countries
: line graph showing how the population is approaching its limit on earth in time
: point dot frequency graph of human perspectives: space vs time
: point dot frequency graph of GNP compared to the energy consumption of different nations
: multi-line graph of the interdependency of population, food production, resource consumption, pollution, and industrial output: world model

Procedure: Start off with the multibar graph of calorie and protein consumption and then the graph comparing the GNP's and energy consumption. Students will see how well off their country is compared to the rest of the world.

Next show the graph of population approaching its limit. Discuss the movement to the suburbs (i.e. Maine, New Hampshire, Vermont). Talk of such things as exponential growth, "perfect" birth control.

If [birth rate] - [mortality rate] then = [constant population]

how medicine is perpetuating us: good or bad??? cloning, etc. and most importantly how will this affect the earth?

Now show point dot frequency graph on human perspectives - how we really aren't concerned with the future beyond our lives, etc.

Finally show the multi-line graph - world model and how the other inputs revolve around population growth or no growth.

"ORIENTEERING"

General system graphics to micro system hydrographics

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Note to Teacher:

General Procedural: At this point the student should be presented with curriculum materials which make the transition into the study of our specific water environment system smoother and natural. In order to achieve this goal it is essential that considerable time be initially spent reviewing and further developing the students' ability to categorize several significant environmental types around him and a similarly large number of study perspectives (or "ways of looking at things") from which these environmental system types can be viewed.

After leading the class to a discussion to specifically study the water environment from the perspective of an average citizen in the local community, the instructor should address the issue of focus and scope as these factors relate to said water environment.

Since one of the main teaching aids which would have been used to cultivate student interest in focusing study upon the water environment should have been an exposure to a series of recent local news articles on this subject (as well as many others), it is reasonable to reintroduce here an analysis of the various boundary limits (and focus areas contained within these limits) which are implied or closely delineated in said articles.

A final breakdown of conceptualization is needed at this point to complete the student's preparation for the water unit. It is necessary to clearly describe here the heavy emphasis upon the evaluative-analytical nature of our next departure into learning. That is to say that we must be certain the student clearly understands that a good deal of study will be made of the existing condition in which we find various aspects of the present water environment; i.e.: we shall dispassionately inventory and evaluate, for example, the conditions which relate to present water supply patterns: the conditions which relate to present water quality levels; The present given rental control pattern conditions related to the water environment, etc.

Science - Cycle II

Summative Objectives:

1. The student will further develop his ability to work with the ideas and thought processes that are necessary to understand the relationships between general and specific environmental systems.

2. The student will become consciously more confident of his ability to understand the systemic processes and patterns which function within his own environment.

3. The student will realize that the following water environment focus is to represent an example of how many of the other 107 urban systems can be studied and comprehended.

4. The student will begin to understand the time - values - change mix as it relates to planning for regions and planning sites within regions.

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Science - Cycle II

Lesson I: Transition: General Systems to Specific "Vehicle" System

Note: The first lesson might also be more fully entitled: Introduction to Using a modicum of the total environment as a means of creating a personal interpretative model which is applicable to the study of all environments ....i.e., "an expanding environmental gastalt learning model"

Time: 8-10 mods

Materials: See compendium of "Total time - total environment graphic teacher aids"

Objectives:

1. Provided with a series of QUEST holograph models which deliniate various "pure-natural", pure-built, and natural plus built plus man multi scale systemic states and processes from a series of time frames (such as "neo-technical", "prehistorical", "technical agrarian", "post industrial and urban" etc.), the student will reduce all systems into the following general categories of study with 70% accuracy: economic, religious, legal, governmental, philosophical-ethical, ecological and architectural.

2. Provided with a series of ten randomly selected holographic place-time-setting models from the "man-construct" category, the student will list a minimum of ten environmental-sociological factors which are common to all: he will further organize these factors under the following 9 interface types:
.man-man, animal and plant
.man-land, water and air
.man-construct and non construct
.manless system

3. Provided with a QUEST designed "interface sphere" and a series of "condition inventory" statements, the student will identify the interfacing components, place them upon the sphere and indicate their "cross-connectors".

4. The student will calculate the cross connector permutation possibilities for a given set of interfacing elements.

5. Provided with a set of statements which relate to environmental ideas and values, the student will designate the involved thought processes as being primarily founded upon: economy, aesthetics, efficiency, or prudence....upon Western or Eastern tenets and traditions.... upon Humanistic or Divine precepts....upon Aborigino American Federalist American or urban-industrial American ideals and attitudes.

Procedures:

1. Demonstrate use of holograph as an aid in delineating environmental specifics and converting same to more manageable generalities.

2. Demonstrate how to "fill in" the blanks on the interface sphere.

3. Teach permutation concept - stress the additional element of "infinite perspective validities within environment grid."

4. Present slide tape review of the "History of the development of man, science, technology and urbanism."

5. Discuss implications above portends for future ...."post urbanism", "self-sufficiency trend, etc.

Pitfalls: 1. Insufficient time to cover this important material.

2. Need for further simplification.

Lesson II: "BOUNDARIES to Boundaries"

Time: 4 mods

Materials: See compendium

Objectives:

1. The student will be able to recall 30% of the 53 existing QUEST terms which relate to defining boundaries.

2. The student will recognize 50% of the scale delineator magnitudes for a set of boundary types: i.e. political, anthropological, physiographic, geophysical, bio-chemical, geographical, etc., etc.

3. Provided with two process systems within a physical-social boundary complement (i.e. Standard Metropolitan Statistical Area and the juxtaposing major basin area) the student will list 12 systemic similes and 12" brass connectors relating to said systems. i.e., Riverways and Transportation routes, etc., etc.

4. Provided with a set of boundary magnitudes the student will perform a global to local graticuleshed reduction via the extraction overlay method.

Procedure:

1. Hand out flyer on boundaries and discuss related theory in usual holographic terms.

2. Reduce focus from global graphics re: 8 major delineators to regional graphics via overlays and accompany8ng narrative - then reduce to micro graticules and sheds.

3. Show series of cartoon and headline vignettes which illustrate the tendency of the media and textbooks to undervalue the "local" perspective.

4. Relate terms "intra" and "inter" to highways and rivers.

Pitfalls: further development of teaching aids

Lesson III: Study area delineation and introduction to micro boundary analysis of same

Time: 6 mods

Materials: See compendium

Objectives:

1. Provided with a choice of focusing upon the water related or non water related local human cluster and physiographic divide study areas, the student will elect to study the water related system.

2. Provided with a list of water related hydro-historical hydro-archeological, geographical, hydro-biochemical and hydro-geological concepts concerning the study area and an event-location time place grid, the student will place respective concepts upon the lattice work with 60% accuracy.

3. Provided with a list of design determiner and design control concepts and issues related to the development and present condition of the study area, the student will order these under the following factor categories: planning, governmental, economic, legal, political, engineering limitations and social stress.

4. Provided with a list of names of the regional historical movements concerned with various levels of secession from broad boundary control and development of local water ways and related forced involvements and social-economic dependencies placed upon owners and users of said waterways, the student will discriminate between those which involve federal, state and local powers and private corporate and individual "rights".

Procedure:

1. Review with students the global and national system categories and processes and then sequentially zoom in on regional and local dimensions.

2. Outline the system options open to study and lead students into a selection of water, air and land...in sequence. (Involve seasonal awareness in this process.)

3. Outline total water related system on regional and then local level (includes historical and future as well as present).

study area, the student will order these under the following factor categories: planning, governmental, economic, legal, political, engineering limitations and social stress.

4. Provided with a list of names of the regional historical movements concerned with various levels of secession from broad boundary control and development of local water ways and related social-economic dependencies placed upon owners and users of said water ways, the student will discriminate between those which involve federal, state and local powers and private corporate and individual rights".

Procedure:

1. Review with students the global and national system categories and processes and then sequentially zoom in on regional and local dimensions.

2. Outline the system options open to study and lead students into a selection of water, air, and land...in sequence. (Involve seasonal awareness in this process.)

3. Outline total water related system on regional and then local level (includes historical and future as well as present).

4. Discuss historical water related conflicts associated with regional and local development, design control, and built-form arrangements... update to present.

5. Discuss rationale for confidence over the long term regarding the future quality of the water related system, i.e. show slides of regional and local dredging scene, filmstrip on Ohio River restoration and renewal project, articles concerning heavy equipment, aggregate, and new methods of landscape rejuvenation and restoration, and models of good water management from the earliest days of the technological period to present.

6. Discuss water related aspects of national design control, Dept. of Health and Interior standards, B.O.C.A. water standards, etc. and sequentially zoom down to the local zoning regulations.

7. Discuss the planning process...show Hawaii state master plan and Ames proposal for a Mass. state master plan...relate all to the water environment.

8. Show the Corps of Engineering slides on population and water demand - Show C.B.S. documentary "Water Famine".

9. Present material on the history of "Regionalism in New England" and riparian legal development.

REGIONAL ECONOMIC ENVIRONMENT

Social Science - Cycle III

Summative Objective

Students will gain an understanding of the regional economic development problems the Brockton area faces. They will evaluate the two alternative economic futures proposed by the Regional Planning Council for the area in terms of their environmental and social impacts on the area.

Formative Objectives

1. Students will identify at least two reasons for using a regional approach in studying and planning for economic development.

2. Using the Regional Economic Base Study and Development Program as a reference, students will be able to interpret the meaning of economic factors used to describe the overall economic situation in the region, through the completion of a study guide based on the economic base study.

3. Given a multiple choice situation, students will identify the major findings of the Economic Base Study.

4. Students will list at least five obstacles to the region's economic development and be able to outline a strategy for overcoming these obstacles.

5. Using census data and the Regional Manpower Planning Reports, students will determine the extent and type of poverty in the area, and will be able to discuss the relevance of "social indicators" of proverty (education level, family size, ethnic origin, age, etc.) to the Brockton area.

6. Students will evaluate in writing the principal alternative economic futures facing the Brockton region.

7. Students will examine in class, at least two case studies illustrating the types of environmental questions raised by prospects of economic development in the region and, when given a hypothetical third case, will be able to prepare their own predictions of probable environmental and economic impacts.

Cycle III - Regional Economic Development

Outline of lessons

1. Introduction to concept and dynamics of suburbanization, with examples of the regional economic and environmental problems resulting from this process in the Brockton area.

2. Explanation of the Regional Economic Base Planning Study and instruction about use of accompanying study guide.

3. Discussion of poverty and unemployment problems in Brockton and time for individualized work on study guide.

4. or 5.(depends on lab schedule - this lesson should be done on 3 mod day). Preparation for seminar discussion on the state economy.

5. Completion of study guide.

6. Seminar discussion on State economic environment.

7. Review and presentation of case studies.

Idea for further development

The length of the unit should be extended by two days to insure that students understand the regional economic concepts discussed in the BASE STUDY and can evaluate the alternative solutions to Brockton's economic situation. A technique for evaluating this understanding is scenario-writing. Students could be divided into groups to prepare scenarios of proposed alternative economic futures (a) continued development as a residential and service center for Boston metropolitan area or (b) development of an independent industrialized base. Their scenarios should include discussion of factors such as land use changes, employment shifts, taxes, expansion of services, etc. A model is provided in the publication CALIFORNIA TOMORROW ed. by Alfred Heller, William Kaufmann, Inc., LosAltos, California, 1971, 1972.

A second recommendation is to reserve the seminar based on the Globe articles for those students in honors and advanced levels, who could perhaps prepare a MEET THE PRESS - or - FACE THE NATION type panel.

Also, in lesson three there is room for further co-ordination between math and social science sections. In math statistical/ graphing) section, students translate census tract data into graphs. Perhaps they could orient this work to discover possible correlations in indicators of educational level, age, labor skills, etc. to income levels.

Also, since this unit was prepared the IRC has received a 2-filmstrip series: "Regional Planning and the Housing Crisis" by Associated Press productions. The first filmstrip particularly emphasizes the regional nature of development questions and is highly recommended for use in this unit.

Lesson I: Suburbanization

Objectives: Students will identify at least two reasons for using a regional approach in studying and planning for economic development.

Students will be able to interpret the meaning of the suburbanization process which is changing the character of the Brockton region.

Students will examine a case study illustrating the types of environmental questions raised by prospects of economic development in the region.

Materials: overheads
lecture notes

Procedure: See lecture notes.

Lecture notes on suburbanization

Use overhead-graph of population growth in Brockton.

Question: What accounted for population growth at turn of century? (Growth of shoe industry.)
What accounted for population decline in 30's-40's? (Decline of shoe industry, WW II.)
Where did people go? (Where there were jobs.)
Why did population start growing again in late 40's-50's? What is attracting people back to Brockton? (building of housing - first, single-families, then multi-family dwellings)
Why would people want to live here if there are no jobs? (jobs in Boston; people can commute to work.)

The growth of Brockton's population in the 50's and its continued growth in the 60's and 70's (according to 1970 census reports Brockton was one of the top ten fastest growing areas in country) can best be understood if you look at the trends on a <u>regional basis</u>.

(Use overhead of Boston and Southeast Massachusetts communities).
Prior to WWII the Brockton region was an independent industrial center - the area we now call the Brockton Standard Metropolitan Statistical Area was tied to Brockton for employment

and services. After WWII, a period of economic displacement was evident. Some of the forces that contributed to this economic displacement were:

a. decline in manufacturing in Brockton
b. development of new industry in Boston - 128 area
c. building of Rtes 128 and 24
d. change in people's lifestyles - desire to leave congested urban areas and move to suburbs coupled with financial assistance to do so.

Such economic displacement resulted in the following demographic and economic shifts:

A. movement of people out of city to areas where housing was relatively cheap, and within reasonable distance of jobs and families. Brockton was an easy place to build - the councilors, zoning board, planning board, etc. allowed developers to claim hundreds of acres of land in the perimeter of the city and to build without restriction. Brockton gave the same free hand to the construction of shopping malls which came to where the people were.

B. Thus the second phase, growth of service industries to meet the needs of people - shopping centers, professional buildings, fast-food stores, gas stations. The expansion of shopping areas in outer perimeter of city also further added to the decline of the inner urban area as a commercial center.

C. The third phase, which we're hopefully seeing the beginning of - is the movement of industry-related jobs into the area. This is a result of the planned industrial development in Stoughton, Avon and to some extent in Brockton.

Why is industry moving out of the Boston area?

a. taxes are high
b. land is expensive
c. wage levels are higher than in other cities
d. construction costs are high
e. living space for their employees and executives is scarce and expensive

The Brockton region, with the exclusion of City of Brockton*, has on the other hand, lower taxes, more land and cheaper land, a lower level of wages, and a more suburban living situation. Also transportation costs are reasonable, and it is close enough to Boston to take advantage of research facilities there. *(Its taxes are third highest in State after Boston and Chelsea.)

Question: Why are research facilities so important to large firms?

Answer: Recall in Unit II, one of the main purposes of any firm is growth - it can do this by creating new markets for new products.

These movements can only be identified on a regional basis and change within any town also has an impact on the entire region.

For example:

An industry decides to locate in Avon Industrial Park, but such industrial development must promise improved transportation access, additional supplies of water, and sewage facilities. Industry brings more people, thus more housing of low and moderate income levels which workers can afford must be supplied. Since there is little developable land in Avon, developers will seek land in communities unprepared or unwilling to control development. Brockton has been devasted by this type of development - a glance at the land use map overhead illustrates extent of land claimed for residential use. Since there is little land left to develop in the city limits, development is moving toward Easton and the Bridgewaters. These towns have learned from Brockton's experience and are adopting stricter zoning and land use control laws. Some of the neighboring towns have called moratoriums on <u>all</u> residential construction. If this attitude continues it will perhaps discourage further industrial expansion - so a "vicious circle" is formed. Many feel only cooperate regional planning efforts can "straighten out" the circle and give some direction to the future growth of the communities in the Brockton area.

Lesson II: Regional Economic Base Study

Objectives: Using the Regional Base Study and Development Program as a reference, student will be able to interpret the meaning of economic factors used to describe the overall economic situation in the region through the completion of an accompanying study guide.

Materials: Copies of the Regional Economic Base Study and the accompanying Study Guide.

Procedure: Pass out copies of the Base Study.
Explain the main objective of such a study is to develop a clearer understanding of the economic situation in an area so that informed planning decisions can be made.
Outline the main <u>indicators</u> used in the study:

- employment patterns
- land use patterns
- shopper patterns
- types of economic activities: manufacturing, retail, wholesale, services

Explain use of study guide.
Ask students to read the study thoroughly, and to question freely. Pass out glossary to aid them in reading.

Lesson III: Problem of Poverty and Unemployment in Brockton

Objectives: Using census data and the Regional Manpower Planning Reports, students will determine the extent and type of poverty in the Brockton area, and will be able to discuss the relevance of the "social indicators" of poverty (education level, family size, ethnic origin, age, etc.) to the Brockton area.

Procedure:

1. Refer to census data which students will have graphed in math section and discuss relationships of educational level, family size, ethnic origin, age, and type of employment to income level.

2. Discuss findings of current Manpower Planning Report for Brockton SMSA (should be available from Mass. Dept. of Employment Security, Brockton office) particularly section discussing BARRIERS TO EMPLOYMENT.

   Discuss which of these barriers can be overcome by individual or are dependent on action at some other level. For example, the 1973 report discusses four major barriers: the lack of

   1. public transportation
   2. day-care facilities
   3. vocational training programs that match skills to needs of labor market
   4. mastery of English language

   Discuss the relationship of poverty to conditions of unemployment and underemployment. Explain the concept of primary and secondary labor markets, and the factors which relegate certain individuals to secondary market. Use overheads illustrating extent of poverty in Brockton area as arbitrarily defined by three criteria most often used by agencies and economists:

   1. lowest 20% of income
   2. 1/2 median income level
   3. minimum income level established by state welfare agency ($130 a week for family of four in Mass. in 1974)

   Discuss the problem of underemployment and the negative work incentives often resulting from welfare abuse. Discuss proposed reforms of welfare system, WIN program, guaranteed

annual income, etc. as time permits.
Discuss, lastly, the conclusions of phase II of the Economic Base Study regarding the type of jobs expected to be attracted to area.
(see overheads and report)

Lesson IV: The Impact of the State Economy on the Brockton area

Objectives: Students will identify and discuss the impact of State government on the economic situation in the Brockton regions through policies of taxation, welfare, labor compensation, etc. as examples of obstacles or incentives to economic development in area.

Materials: reprints from the Boston Globe on Massachusetts Economy: Myths and Realities, March 19 to May 28, 1973

Procedure: Explain the purposes and format of a seminar discussion: a group learning situation involving the discussion of a common concern. Each member of the group is expected to share his/her perspective on the subject, raising questions, seeking to pull together ideas.

Each person will prepare an article with a partner for presentation in an informal discussion. Discuss with class how the presentation should be evaluated: clarity? length? understanding of relationship to Brockton area? etc.

Ask students to use class time to read article, decide how team should make presentation, and to outline article on paper. Ask that outline be handed in at end of period (in case of absence and also to help you in evaluating their skill in interpreting the article).

The next day, allow each team about 5 minutes for the presentation of the article, and then raise questions that will generate discussion.
For example:
Will the development of technologically-oriented industry around Rte 128 affect the unemployment situation in Brockton?

Do you agree with the pro-labor position of the state legislature? (welfare, unemployment compensation, etc.)

NOTE: More specific material dealing with welfare, welfare reform, unemployment benefits and programs, etc., should be added or substituted for Globe articles. These articles will need to be selected in advance.

Lesson V: Review and presentation of case studies

Objectives: Students will examine in class at least two case studies illustrating the types of environmental questions raised by prospects of economic development in the region. When given a hypothetical third situation, students will be able to prepare their own predictions of probable environmental and economic impacts.

Materials: overhead of Brockton SMSA - Old Colony Planning and (1) overlay of river systems and (2) overlay of proposed route of 4-lane limited access East-West Highway

overhead of outline of criteria required in environmental impact statements

Note: Because this 5-day cycle proved too limited for material projected, this lesson was only partially covered.

Procedure: Explain the idea of brainstorming sessions with class: "We are going to try to project the future impact of some of the recommendations made by the OCPC in their report. This overhead illustrates some of the categories of impacts used by state and federal environmental agencies. After I describe a possible future event, I want you to call out any possible impacts or problems you can think of in any category. We'll discuss them all at the end. There will be no discussions during brainstorming."

Outline two possible situations.

a. construction of a regional sewage treatment plant

b. construction of East-West highway
Divide board space into section a and b and record all responses.
Raise questions to prompt responses. For example in situation (a) can a regional sewage plant be located anywhere in Basin? Who will benefit most? least? What kinds of cooperation will be necessary?

When ideas for each situation are exhausted spend some time grouping responses into categories outlined for impact statement. Ask for discussion of which impacts are most likely to occur, most serious, etc.

If time permits, have students, working in smaller groups, repeat this procedure for third situation: (c) construction of U. Mass. Campus in Brockton.

STATISTICS

Cycle III - Statistics

General Objective: The student will be able to calculate the mean, median, and mode and make conclusions about a range of numbers. Working with 1970 Census of Population and Housing, the student will apply this knowledge to his own neighborhood. Finally the student will calculate standard deviation and place this material on a bell shape curve.

Objectives:

1. The student will start to gain some insight as to what an average is - the mean, the median, the mode.
2. The student will calculate the mean, median and mode of data.
3. The student will interpret the mean, median and mode of data.
4. The student will state the purpose for finding an "average".
5. The student will apply the meaning of the relationship between the mean and median to his own neighborhood.
6. The student will calculate range and standard deviation.
7. The student will be able to graph a normal curve after finding the standard deviation and mean.
8. The student will be able to state between what two figures 68% of the values center around.

Lesson I

Title: An Introduction to an Average

Objectives: 1. The student will start to gain insight as to what an average is - the mean, median, and mode

Time: 2 mods

Materials: filmstrip "Descriptive Statistics" - part 1
overhead of A and B scores

Assignment: Read Chapter 2 in How to Lie with Statistics

Procedure:

I. Review statistician's job

1. collect data done in Cycle II
2. organize data done in Cycle II
3. analyze data we're going to do
4. make conclusions

II. Show filmstrip

A. Review what filmstrip said as far as the calculation of the mean, median, mode

1. Mean = $\frac{Ex}{N}$
2. Median = middle figure - put in order first - if an even number of terms, take the middle two, add and divide by 2.
3. Mode = most frequent - if 2 modes = bi-modal

III. Put up overhead of quiz scores and have them find mean, median and mode.

IV. If time, see if anyone picked up what conclusion can be made according to the filmstrip.

Lesson II

Title: What does the average mean?

Objectives: 1. The student will calculate the mean, median and mode of data.

2. The student will interpret the mean, median and mode of data.

3. The student will state the purpose for finding an "average".

Time: 2 mods

Materials: overheads of class scores A & B
carbon copies of range of school year completed, average income, coliform counts, test scores

Assignments: finish 2 carbon copies

Procedure: I. Review formula for finding the mean, median and mode.

2. A. Tell what they each mean

II. Introduce formula of weighted mean

A. If mean is greater than the median you have a few very high scores pulling the mean up and the numbers tend towards the low side of the mean.

B. If the mean is less than the median you have a few very low scores pulling the mean down and the numbers tend twward the high side of the mean.

III. The Mode

A. has very little value since there may be more than one, or the mode may be an extreme and no where near the others.

IV. Problems

A. Refers to a scale - put = weights on either side, now place a 1 lb. weight on one side and a 10 lb weight on the other side. The mean remains the same but it weighted down on one side.

V. Homework

A. Pick up places in last night's reading assignment where mean, median and mode relationship occur.

1. What happened to the company incomes?

VI. Students should ask "which average?"

VII. Purpose of an average:

A. To find one number to describe a set which all the numbers tend to center around.

Lesson III

Title: What's My Neighborhood Like?

Objective: The student will apply the meaning of the relationship between the mean and median to his own neighborhood.

Time: 2 mods

Materials: 1970 Census of Population and Housing overheads of:
census tracts of Brockton, Mass.
pH-2 of census taacts
H-5 of census tracts
H-1 of census tracts
P-11-12 of census tracts

Assignment: None

Procedure:

I. Have the students find out what tract they live in.

II. Put page P-11 on overhead - explain how to read page.

A. At top of page point out the mean income and median income of each family.

1. Point out 5106 mean is higher.

a. a lot of $50,000 + where bulk of incomes is below $15,000

III. Compare the mean value of their homes to median value.

A. Also compare mean and median gross rents.

1. p. P-11 and p. P-12 bottom

IV. On p. H-2 are median values and on H-5 are median gross rents.

A. Have them find their own.

B. Determine what tracts have sizeable differences.

V. See if they can find any more mean and median values.

Lesson IV

Title: Finding Standard Deviation

Objective: The student will calculate range and standard deviation.

Time: 2 mods

Materials: Overhead of: how to do standard deviation
: scores A
" scores B
: Make sure they have carbons they did two days ago for M-M-M.

Assignment: Read Patterns in the Sand p. 227-233
Do p. 234 and 2a, b, c
Find standard deviation for 2 carbon copies.

Procedure:

I. Show overhead of 2 sets of numbers
A = 5,5,6,8,9,9,10,10,10
B = 1,2,3,4,8,10,10,11,12,19

A. Ask students to discuss what's different about 2 sets of scores.

1. Have them find M-M-M of each.

B. Review reason for finding an average - one number to describe a set.

1. If 2 sets have the same average and are different then the average doesn't clearly describe what the set is doing.

a. Have the same center point but vary or deviate differently so we need some other method.

II. Introduce range:
Range A = 10-5 = 5 highest - lowest = range
Range B = 19 - 1 = 18

A. But these only deal with extremes - suppose we change A = 1,5,5,6,8,9,9,10,10,10,15 we still have a mean of 8, the numbers are farther apart and the range now is 14 - much closer to that of B.

1. This isn't really clear either so we have Standard Deviation.

IV. Put on overhead on how to find standard deviation.

A. Have students copy and memorize.

Standard Deviation:

1. Find mean of the number.
2. Find the difference between the mean and each number.
3. Square each of these differences.
4. Find mean of squared numbers.
5. Find $\sqrt{\ }$ of the mean in Step 4.

$$\sigma = \sqrt{\frac{\Sigma (x - \bar{x})^2}{n}}$$

V. Now have student calculate σ for set A and Set B.

Lesson V

Title: Normal Curve

Objective: The student will be able to graph a normal curve after finding the standard deviation and mean.

The student will be able to state between what two figures 68% of the values center around.

Time: 2 mods

Materials: Overhead of: histogram
: normal curve
: normal curve with percentages

Assignment: Study for quiz

Procedure:

I. Show overhead of histogram and normal curve.

A. Review histogram: where heaviest frequency is the highest point of the histogram - in this case - the center

B. Draw the midpoints of the intervals and connect then we get a normal curve or bell curve.

II. Show overhead of normal curve with % and have kids copy it down.

A. Explain how the mean is the center and each line is one standard deviation length away.

III. Review finding standard deviation.

IV. Tell students that approximately 68% of the scores will <u>always</u> land between $\pm$ / S.D. of the mean.

A. Now the students can spread out the numbers for Sets A and B.

B. Explain difference between a long, slim curve and short, fat curve.

V. Have them do normal curves for carbon copies.

Follow up: Arrange work with census tract more carefully - could easily spend 2 days on it.

Find more relevant examples (maybe again - futuristic)

Maybe kids could take their own census. (a classroom or his neighborhood.

WATER ANALYSIS

General Objectives for Cycle III

Summative

Provided with a Water Quality criteria handbook and a water sample, the student will analyze and sample for any single parameter for which he has acquired the necessary technique and will produce a one paragraph summary relating to the ecological implications, the economic implications and the legal criteria implications relevant to his analytical findings.

Provided with a series of analytical readings from the local reservoir, Flag Pond and the Reservoir at Silver Lake, the student will order in tabular form the various findings under the various categorical sampling locations.

General Objectives of Overview - Cycle II

The following outlines in a general way, the objective focus of this cycle.

To broaden the students understanding of the use of the equipment he was introduced to in Cycle I.

To develop further understanding of the 12 basic legal standards for the eight classes of water.

To develop an awareness of the geographic elements involved in analyzing environmental problems; i.e., micro to macro geography concepts will extend over the range from the micro geographical analysis of samples obtained within the 600 acre D. W. Field to the samples obtained at the Silver Lake facility (14 miles away) and the Sewage Treatment plant facility 4.2 miles away. It is at this point that the student begins to learn to evaluate his environment in terms of the QUEST designed expanding time space grid schema by moving from a neighborhood land use focus to a "related municipal facilities" focus.

To synthesize the concepts learned in the orienteering section with the water geography concepts introduced in this section in accordance with the philosophy of the "expanding learning model" mentioned earlier.

Specific Cycle III Objectives - Behaviorally Stated

1. Provided with the necessary analysis kit, a water sample and the water pollution control criteria sheet for the eight basic pollution parameters, the student will classify the legality of said sample with 60% accuracy.

2. Provided with an unlabeled physiographic map delineating the basic aspects important to Brockton area water supply and water quality, the student will label said map and interpret supply and quality control factors for specific locations with 70% accuracy.

3. Provided with an analysis kit that the student was "introduced" to in Cycle I and a water sample, the student will demonstrate that he has improved his ability to work efficiently and accurately with said kit by determining pollution values to within 65% of accuracy and by correctly answering 75% of a series of questions related to the respective analysis.

4. Provided with a statement which requires that the student understand the effects of adverse land use practices upon the quality of aquatic ecosystems and economic systems within specific and important macro and micro basin locations in the greater Brockton area, the student will answer a set of said questions with 65% accuracy.

5. Provided with a list of correct and incorrect statements relative to the geo-environmental relationships that exist between D. W. Field Park and surrounding regional facilities, the student will discriminate between the correct and incorrect relationships with 65% accuracy.

6. Provided with a set of hypothetical local water environment data, the student will create his own symbol system and scale-boundary portrayal system relative to said data.

7. Provided with a drawing of the materials used in the basic abiotic and biotic analysis (i.e. Hach and Millipore and LaMotte) the student will name said materials with 60% accuracy and describe their respective functions.

8. Provided with a diagram of the principal parts of a Hach kit, a list of correct and incorrect statements describing their purpose and function, the student will discriminate between the said correct and incorrect statements with 60% accuracy.

9. Given a series of statements regarding basic asceptic and procedural techniques of using the Hach and Millipore equipment in analyzing water, the student will select the one correct statement in 70% of the test occasions.

10. Students will be able to answer correctly 70% of a series of questions dealing with the relationships between water supply and sewage treatment problems in the D. W. Field Park area.

11. Provided with a Millipore apparatus for determining the number of total coliform per 100 ml in .1, 1 and 10 aliquot samples, the student will determine the true colony concentration with 95% accuracy.

12. Provided with a list of terms and processes involved in water and sewage treatment, the student will differentiate correct form in 60% of the cases.

Student will correctly (80% or better) label the essential stages of local water and sewage treatment.

13. Given a series of petrie dishes which have produced varying numbers of coliform colonies under varied dilution conditions, the student will calculate colony density per 100 mls and classify the water as A, B, C, D, or E.

14. Provided with a Hach Kit, water samples, and a QUEST designed outline of procedures for the introductory analysis of three chemical constituents, the student will determine the P.P.M. value of said constituents (using the spectrophotometer with 60% accuracy.)

15. Provided with Table 4 of the "Water Quality Criteria for Coastal and Marine Waters in Massachusetts" and maps showing land use in the vicinity of D. W. Field Park, Silver Lake, Monponsett Pond and Furnace Pond, 80% of the students will select the coliform and chemical constituents aspects (# 4 and 8) as two of the primary parameters to consider in relation to evaluating positive and negative aspects of proposed change around D. W. Field Park.

16. Provided with the above Criteria Table and a series of eco-system diagrams the student will label the aspects of said diagrams which relate to specific Massachusetts state water quality parameters with 75% accuracy.

17. Provided with diagrams of pre-filled graduated cylinders, pipettes, burettes, etc., the student will correctly read the respective measured values on said cylinders.

18. Provided with a diagram showing the various components of the Millipore coliform analysis kit, the student will correctly identify each component and define the unique purpose of each component with 80% accuracy.

19. Provided with a fresh water sample and pipette the student will correctly dilute and filter same through the 47u filter.

20. Provided with tongs and an autoclave the student will demonstrate the proper sterilizer and storage technique to be used when one has completed the millipore analysis.

21. Provided with a diagram showing the various parts of a millipore filtration apparatus, the student will name said parts.

Lesson I

Lesson Title: Analysis: What and why

Time: one mod

Objectives:

1. Provided with a list of types of water uses, the student will differentiate (with 70% accuracy) between those uses which require potable quality and those which do not require potable quality.

2. Provided with a disordered list of water quality study categories the student will correctly order same.

3. Provided with a mixed list of ecological-environmental and legal criteria, the student will differentiate between these two groups with 70% accuracy.

4. Provided with a blank schematic of control and management components relating to maintenance of water quality, the student will correctly fill in 70% of the blanks.

Equipment & Materials:

1. Set of overheads and handouts re above

2. Overhead projector

Procedure:

1. Describe the types of water uses; i.e. washing, drinking, industrial, etc.

2. Outline quality, supply, recreation domains of study.

3. Describe the conflict between legal and environmental criteria.

4. Outline a good water management model - relate to general environmental management model.

Pitfalls:

1. Needs more teacher aid materials development

Lesson II

Lesson Title: Abiotic Chemical Analysis of Water
(Spectro-colorimetric technique)

Time: 4 mods

Objectives:

1. Provided with a Hach kit, water samples and a QUEST devised outline of procedures for the analysis of three chemical constituents, the student will determine the P.P.M. value of said constituents (using the spectrophotometer) with 60% accuracy.

2. Provided with a diagram of the principal parts of a Hach kit, a list of correct and incorrect statements describing their purpose and function, the student will discriminate between the said correct and incorrect statements with 60% accuracy.

Materials and Equipment:

1. Hach Kit; one, five and ten PPM solutions of copper, iron and chromium; instruction guides

2. Overhead and handout guide sheets describing Hach equipment

Pitfalls:

1. Demonstrate procedure very slowly.

2. Ion settling problem can be avoided by constantly stirring sample.

3. Asceptic procedure is a must.

4. Safety re: caustics is a must.

5. Watch for burette reading errors. (Unit concept)

6. Clarify "end point" determination.

7. Often the "swirling" technique is poor.

8. Review expressing partial units in desired form so that P.P.M. value per drop can be converted to precise P.P.M. value for each test.

9. Lack of careful reading of procedures.

10. Interpolating color values on wide scale color comparator confuses some.

11. Failure to understand and retain the concepts and apply the skills related to asceptic technique, e.g. distilled water usage on glassware, etc. is a common problem.

Ideas for further development:

1. There are many improvements in the sterilization procedure which can be worked out in order to train students to obtain valid readings more readily.

2. Create a teaching procedure that will convey the µg vs mg more readily at this point.

3. Develop a more simplified definition of titration as a handout.

4. Design a more complete handout describing all components of the kit.

5. Work out a better definition of "impurities" ....one that does not tend to mislead students to call all concentrations pollutants.

6. Organize a better step by step handout sheet re: each analysis.

7. Devise a lab check and an equipment checking technique that is not so time-consuming.

8. Arrange to have a QUEST II student check all equipment ahead of time for efficacy.

Lesson III

Lesson Title: Culturally related micro biological analysis of the local water environment (using a filter and selective media technique)

Objectives:

1. Provided with a Millipore apparatus for determining the number of total coliform per .1L, the student will determine (via .1, 1, 10 ml aliquots) the true colony concentration with 95% accuracy.

2. Provided with a diagram showing the various components of the Millipore coliform analysis kit, the student will correctly identify each component and define the unique purpose of each component with 80% accuracy.

3. Provided with the Millipore membrane filter kit and an assembly guide sheet, the student will correctly organize the materials in the kit for doing a coliform analysis.

4. Provided with a fresh water sample and pipette the student will correctly dilute and filter same through the 47u filter.

5. Provided with an alcohol burner, forceps and a guide sheet, the student will demonstrate asceptic technique in handling the filter before and after filtration.

6. Provided with tongs and an autoclave the student will demonstrate the proper sterilizer and storage technique to be used when one has completed the millipore analysis.

7. Given a series of petrie dishes which have produced varying numbers of coliform colonies under varied dilution conditions, the student will calculate colony density per 100 mls and classify the water as A, B, C or D or EL.

8. Provided with a diagram showing the various parts of a millipore filtration apparatus, the student will name said parts.

Materials and Supplies:

See Procedure guide sheet

Procedure:

1. Briefly demonstrate one complete coliform analysis.

2. Hand out guide sheets.

3. Assist students who appear to be having difficulty.

Teacher Lab Procedure Guide Sheet

Procedure:

Coliform Analysis: Two students per team

4. Hand out guide sheet #2

5. Obtain the following items from the supply cart and the marked supply boxes which should be placed at the front of the room.

   a. 250 ml funnel

   b. filter base

   c. 250 ml receiver flask

   d. envelope of millipore filters and absorbant pads

   e. alcohol burner

   f. forceps

   g. 50 cc syringe

   h. one way valve and hose assembly

   i. one pipette

   j. one ampoule of media *

   k. one ampcule beaker *

   l. one container of sterile distilled water

   m. one wash bucket

   n. one sterilized petrie dish

   o. matches

   p. paper towels

   q. instruction book

   r. pipette pump

Student Procedure: (After briefly demonstrating one complete hand out a sheet with the following instructions.)

1. Arrange the above materials neatly around your lab area.

*Optional: depending upon whether or not instructor provides prepared media solution.

2. Place the filter base inside the funnel and using tongs put them both into boiling water for 30 seconds and place onto paper towel to dry. (If your instructor has provided you with a pre-sterilized base and funnel you may skip the boiling procedure.)

3. Connect the filter base and the receiving flask together - being certain to keep your hands away from the surface of the base.

4. After flaming and cooling forceps obtain a filter from envelope and place grid side up onto the surface of the filter base - be sure filter aligns well with the edge of the base - all the way around.

5. Connect the 250 ml funnel section to the base - make certain that you do not cross thread, or tighten or wrinkle the filter. Also be certain to not touch the inner walls of the funnel with your fingers.

6. Connect the one way hose and valve assembly to each other and then to the nipple on the receiver flask.

7. Squirt about 2 mls of sterile distilled water onto the filter - make certain its surface has been totally wetted.

8. According to your teacher's instructions, pipette a 1/10, 1 or 10 ml sample of the water being tested and double checking your readings on the pipette scale deposit this into the 250 ml funnel - be certain you do not splash the sample water against the funnel walls and that you do not touch the tip of the pipette to the distilled water already in the funnel.

9. Connect the 50 cc syringe to the one way hose and valve assembly and pull syringe plunger in and out slowly.

10. Flame the forceps and obtain a nutrient pad from the envelope.

11. Using the ampoule beaker and an ampoule or the prepared media container, moisten the pad (do not overwet the pad - about 2 mls is sufficient).

12. After sample has filtered through the filter use the flamed forceps to place said filter into the petrie dish - grid side up - on top of the moistened pad.

13. Put the cover on the petrie dish, mark it with a crayon (Sample No., Date and your initials) and place upside down in culture oven.

14. Assist students who appear to be having difficulty counting colonies on the following day.

Pitfalls:

1. Asceptic procedure is easy to overlook.

2. Lack of understanding of the purpose of the test as a result of becoming obsessed with the mechanics of doing the tests.

Lesson IV - Part C

Lesson Title: Biotic chemical analysis of water: titration method

Time: 2-4 mods

Objectives:

1. Provided with a LaMotte Titration analysis kit, a series of QUEST modified analysis instruction sheets, and a water sample, the student will demonstrate his ability to calculate P.P.M. values via titration technique.

2. Provided with a diagram showing the various components of a LaMotte analysis kit, the student will correctly identify each component and define the unique purpose of each respective component.

Procedures:

1. Outline basic safety orderliness and special technique aspects of the investigation.

2. Explain lab grading system.

3. Define size of groups and designate station areas.

4. Have all materials picked up from central location by one member from each group station.

5. Establish a traffic flow pattern for lab area.

6. Stress the importance of reading the analysis procedures carefully "one step at a time".

7. Go through the QUEST designed composite analysis that involves filtering, pipetting, weighing, buretting, and liquid and solid mixing as an initial exposure to materials experience for students. (Use the equipment and supplies diagram in conjunction with above procedure and overhead projection of same.) (Also use plastic overhead trays for titration aspect of demonstration.)

8. Let students select any analysis from list of prepared instructions for their initial exposure to the testing unit.

Further Development:

1. Complete the QUEST designed composite analysis using all components in LaMotte - get overhead reagents.

2. Create better burette reading overhead instruction sheet which more simply portrays increment values for a series

of micro - macro measurements.

3. Complete lab instruction sheets in detail. (Review and modify LaMotte guide.)

4. Develop more student activity and independent activity handouts for lab use of LaMotte kit.

5. Develop tape and slide combo on LaMotte materials and their usage.

6. Further develop student perception relative to the fact that in this test he is making visible the heretofore invisible aspect of his water environment and that established criteria have been set for this domain.

7. Re-emphasize that other environments besides the water environment have criteria that are commonly disregarded in modern urban society.

8. Develop a simpler set of bio-chemical process overlays which more effectively connect these components to the geo-cultural elements dealt with in the preceding orienteering unit.

THE SOCIAL ENVIRONMENT

Social Science - Cycle IV

Summative Objectives:

A. Students will work together to define the meaning of the statement of our national housing policy: "to provide every American family with a decent home and suitable living environment", based on their own experience in the 'living environment' of Brockton.

B. Students will examine the inter-relationship of man and environment by studying

   a. the effects of alternative educational environments on the individual

   b. selected social/psychological theories of human development

   c. case studies of urban and suburban juvenile delinquency

Formative Objectives:

1. Working together as a class, students will develop a working definition of the terms "decent home" and "suitable living environment".

2. Students will compare the kinds of social learning that result from alternative learning situations.

   a. an American high school
   b. an alternative 'free' school
   c. the educational systems of Russia and China

3. Students will identify principles of human social development in theories of social psychologists.

4. Students will read case studies of juvenile "delinquency" and alienation, and will isolate the elements of the living environmat which influence personal development.

Lesson I: The Social Environment

Objectives: Students will interpret the meaning of "decent home" and "suitable living environment" - the stated goals of our national housing policy.

Procedure: Show slides of housing in Brockton. Discuss housing as a social problem that can be discussed from many different viewpoints:

slide sequence	comment
vacant land being developed into apartments	Housing usually means one thing to a developer or real estate agent -- ($)
city hall, city council meeting, traffic congestion, sewage plant, reservoir, schools, Mass. Division of Employment Security, Urban Renewal	another to city officials and planners - (increasing taxes, drain on city services; employment problems; urban renewal)
sameness of single-family homes, aerial shots, homes on West Elm Street, three-deckers, Hill Street	another to an architect
FOR RENT SIGN code violations, dark halls, broken radiators	yet another to landlord yet another to a tenant
pictures from apartment window, kids playing on Brookfield or Southfield streets; kids playing on Lexington Street, in Field's Park	hopefully "home" to the people living there

END

It is the stated goal of our national housing policy to provide every American with a <u>decent home</u> and <u>suitable living environment</u>. Let's explore what these phrases mean.

2. Pass out index cards and direct students to define on one side what is needed to make a "decent home"; on the second side, what is needed for a "suitable living environment".

3. Ask students to help you list different concepts on board.

   Ask other students to group these concepts into two categories: <u>physical needs</u> - those that can be provided for by things
   <u>social needs</u> - those that can only be provided for by human interaction.

Lesson II:

Objective: Students will become familiar with sociological theories.

Procedure: On bulletin board, arrange four sections, each corresponding to one of the following social needs:

a. response
b. recognition
c. security
d. new experience

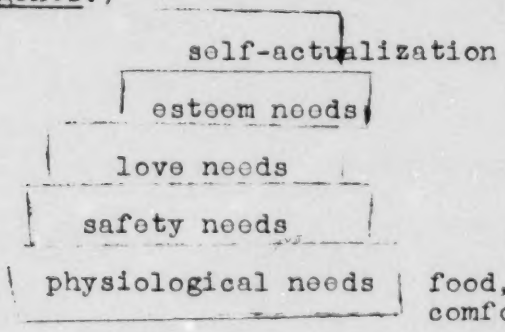
Have students list their own examples of social needs under these headings. Encourage discussion of the meaning of these words and categories.

When above discussion subsides, briefly explain the <u>developmental</u> approach to human growth: "at certain stages in our lives, some of these human needs become more important than others." If in a person's growth certain of these needs are not satisfied, then the personality becomes stunted and not capable of "maturity". (You may want to ask students to define this word since it is often used to discredit adolescent behavior.)

Using Maslow's theory as an example, explain that he feels there are five categories of needs and that these form a <u>hierarchy</u> of human growth. Illustrate the word <u>hierarchy</u>.

Tack Maslow's five categories on board in alphabetical order and ask class to decide the proper sequence. Hint that they should first think of their own experience as an infant growing into childhood, adolescence, and adulthood.

If, after a few minutes, no one is getting close, sketch out the hierarchy as Maslow developed it, and try to clarify any questions students might have. (See page 41 in book <u>Human-Persons and the Use of Psychoactive Agents</u>.)



It was estimated that far less than 10% of the American population reaches Maslow's highest stage. Ask them "what factors in the environment keep people down - keep people from developing into "self-actualized" persons. Accept any suggestions - if some don't seem to make sense, ask student to explain by way of example.

Next, play the three songs on the tape "Where Do the Children Play", "Inner City Blues" and "Twenteeth Century Man". Preface this activity by discussing how music - as any art - is a response to one's environment. Ask students to listen for those factors the vocalists feel are preventing people from fulfilling their needs. Pass out words to songs and (either in class or for homework, depending on time) have students pick at least one song and analyze it - looking for the factors that obstruct human happenings, and the singers description of the human condition that results from it. Give up to 5 points for each song a student does, evaluating analyses in sensitivity expressed. Give extra credit if students will bring in other songs that carry this same message. (Make time next day for students to play their records.)

Lesson III: Comparative Educational Environments

Objective: Students will compare the kinds of social learning that result from alternative learning situations.

a. their own American high school
b. an alternative "free" school
c. the educational system in Communist China

Procedure: Assuming that students will have identified schools as one of the social factors that affects the development of their needs, explain the next few days will be spent trying to understand the impact of schools on the individual and society.

1. Have students write out their responses to the following questions:

   a. What do you believe the main purpose of your education ought to be?

   b. What is the most frustrating thing about your experience in B.H.S.?

   c. What is the most significant thing you've learned at B.H.S. - inside or out of classroom?

   d. How would you define the word "discipline"?

   e. Do you feel students or teachers should be responsible for choosing what is learned? Why?

   Be prepared to discuss these responses in class.

   Some suggestions for discussion:

   If you say education should prepare you for your future, how do you know what that future will be like?

   Are your frustrations the result of the way the school is structured (size, numbers, scheduling) or the result of attitudes of teachers, administrators, or other students?

   Could you have learned this "most significant thing" outside the context of the school?

   How many of you answered that "discipline" was a negative, outwardly imposed thing? that "discipline" was a positive, self-imposed thing? What does it take to learn self-discipline?

What disciplinary rules are most often broken? Why?
Which rules do you feel are unjustified? Why?
To paraphrase a famous remark - "When I was 15 I thought my teachers were the most ignorant people in the world. When I was 21 I realized how much they'd learned in 6 years."
Do you think students are capable of knowing what they need to learn?

2. Pass out copies of two articles:

   a. an article on the educational goals of Chinese Communist society

   b. an article on a "free" or alternative high school situation

   Have students complete the following assignment:
   Compare the kinds of social learning that occurs in each of these situations with what you are learning at Brockton High School. Give examples if you chose to.

Optional lesson:

View slides and filmstrips comparing "The Two Worlds of Childhood" - a unit prepared by QUEST student Terry Madden.

Optional points for discussion

- hand out criteria used to evaluate the students in an open classroom situation (see back-up materials). Have students grade their own behavior.

- have students take survey on "On Assumptions and Attitudes Toward Learning". Ask students to have their parents take same survey and compare ideas.

Lesson IV: Suitable Living Environments

Objective: Students will read case studies of alienation and will isolate the elements of the living environment which negatively influence personal development.

Procedure: Discuss the educational studies which reveal that the factor that most significantly determines academic achievement is economic class. What impact could income have on learning ability?

Pass out articles that examine living environments in two different income classes:

a. low-income housing project (suggested: Soul and Sorrow in the Projects" - Boston Globe magazine)

b. wealthy suburban town - (suggested: "Wandering in Wellesley" - Boston Globe magazine).

Ask students to complete following assignment: Isolate and compare the elements of these two living environments which negatively influence personal development - which frustrate people's needs for safety, security, love, recognition, esteem, and self-actualization.

Lesson V: Juvenile Delinquency

Objective: Students will read and discuss case studies of juvenile "delinquency" and will isolate the elements in the lives of these "cases" which have influenced personal development.

Procedure: Pass out copy of selected excerpts from book No One Will Listen by Lois Forer. Discuss the kind of treatment given juveniles by court system - what did they really need? What services should be provided?

(Next day) Invite speaker from Youth Resources Bureau in Brockton to explain their purposes and programs - which are designed to keep young people from ever entering juvenile justice system.

INTRODUCTION TO PROGRAMMING

Math - Cycle IV

Introduction to Programming

Summative Objectives

1. The student will be able to use the computer to run simple programs in BASIC language.

2. After having completed this unit, the student will be able to write his own program in Basic dealing with variables.

3. The student will be able to realize and justify the use of the computer when dealing with environmental problems.

Lesson I

Lesson Title: The Computer's Work

Objectives:
1. Given a diagram, the student will be able to explain the machinery of the computer.
2. The student will be able to define a program.

Time: 2 mods

Materials: overhead of keyboard of teletype
overhead of diagram of computer's machinery data processing card showing the binary system of letters and numbers.

Procedure:
1. Ask students what they think a computer is, how it works and what exactly it does. Work around this until they understand that the computer only does what we tell it to do. (We can always pull the plug out!)
2. Definition of a Program: series or set of instructions which tell the computer what to do.
3. What kind of problems can the computer solve??? anything that can be defined.

   Definition of defined: broken down into a series of steps which can be written into a series of instructions.

   Example of a problem which cannot be defined: translating the natural languages because of the many shades of meaning.
4. Program instructions must be:

   1. Precise and structural
   2. problem oriented
   3. use familiar words and expressions i.e. BASIC language
5. Most companies use the same language so a program can be used by more than one computer.

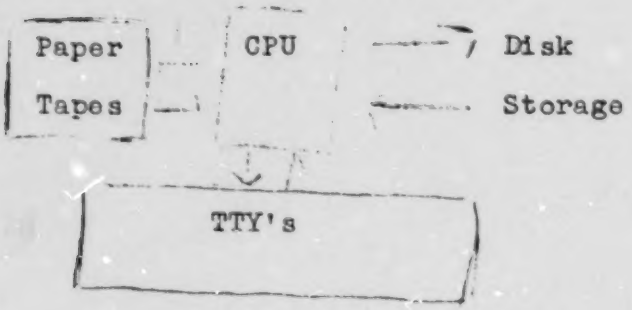
   Four kinds of language
   (1) FORTRAN and ALEOL are used for scientific and engineering problems.

   (2) FOCAL and BASIC for shorter numerical problems.

6. Why do we use the computer?

   1. better and more efficient
   2. receives and processes information faster

7. Overhead of machinery



Place where all the calculating takes place is the CPU - Central Processing Unit.

The disk storage is the memory - a bunch of record albums piled up.

The input/output units are the paper tape readers and the teletypes.

1. Explain input/output.
2. Explain paper tape reader.
3. Show overhead of keyboard.
4. Explain time sharing device - how the computer keeps straight which jobs it is working on. Regulates the flow of programs from memory to CPU.

   Monitor also used to translate computer language into binary code - data cards and to correct program.

   If time allows start reviewing algebraic equations.

Assignment: Read Chapter 1 in Basic

Linear Equations for homework

1. $3x = 27$
2. $-2x = 4(-7)$
3. $4t = 56$
4. $3(x+2) = 15$
5. $10 = 5(y-7)$
6. $4x + 3x - 1 = 1 - 2x + 8x$
7. $6(2h - 3) = 4h - 2(3h - 5)$
8. $19 = 4(z - 2) - 3(z + 2) - 2(2z - 3)$
9. find f(0), f(3) and f(-2) for

   $x^2 - x + 3$

and

10. $\dfrac{x^3 + 3}{x^2 - 4}$

11. find f(-2) for

    $2x^3 = x^2 - 3x + 4$

12. find f(5) for

    $2x^3 - 1$

13. find f(3) for

    $x^3 + x$

14. find f($-\frac{1}{2}$) for

    $1 - x + 2x^2 + 6x^3 + 12x^4$

Lesson II

Title: Equations

Objective: Given a set of arithmetic and algebraic equations, the student will transform them into computer notation (BASIC language) by using the proper variables, parenthesis and order of operations.

Time: 2 mods

Materials: 2 worksheets on algebraic equation - 1 to be converted into BASIC language

Procedure: Briefly go over solving algebraic equations with them and then work together on the 10 examples.

Explain how the computer works around a problem.

Amount of rainfall = rate of rainfall x amount of time the rain fell.

Computer cannot read this so you have to change it into variables.

T = time
R = rate
A = amount

$A = R \times T$

Variables: one letter or one letter followed by one number
OK: A, B, C or A1, B2, C3
Not allowed: M65, T61, OK1, 3B, 72A

Try to Solve: $F = 5x + 3Y^{z} + \frac{2z}{3}$ if $x = 1$ $y = z$ $z = 3$

AND THINK ABOUT YOUR ORDER OF OPERATIONS

Parenthesis first
Raise to a power
Multiply then divide
Add then subtract

Show what happens when 2Z/3 is changed to 2 + Z/3 - indicates need for parenthesis.

Do in class together

$$\frac{\left(\frac{A - B}{C} \cdot (D^2)\right)}{F}$$

$$X \frac{-B^2 - 4AC}{2A}$$ quadratic formula

Can use as many parenthesis as you feel safe with.

Assignment: Finish worksheets and #1 on page 12 in BASIC.

Lesson III

Title: LOG IN and LOG OUT

Objective: Given the use of the teletype and the proper instruction, the student will be able to LOG IN and LOG OUT on the computer.

Time: 3 mods

Materials: procedure sheet on LOG IN and LOG OUT and a simple program

Procedure: Go over Procedure sheet with everyone STEP BY STEP demonstrating at each step.

Let every kid do it himself - perhaps you could have a few QUEST II kids helping you.

Assignment: review notes

Lesson IV

Title: Writing Programs

Objectives: 1. Given a program, the student will be able to identify and utilize the REM, READ, LET, PRINT, DATA, END and GO TO statements.

2. The student will be able to write simple programs.

Time: 2 mods

Materials: three handwritten overheads of various statements and their purposes
3 typed overheads of commands and examples

Procedure: Go back to rainfall problem A = R*T and change it to A = 5*10.

Write a simple program on board using LET, PRINT, END

Now show overheads of statements.

This is not exactly like a math problem where you solve it the same way following the same formula time after time. Programs can be written differently.

Explain the numbering of lines - to be able to insert additional lines.

1. Program finding the number of seconds/yr.

```
10 LET S = 60 SEC/MIN
15 LET M = 60 MIN/HR
30 LET H = S*M
25 PRINT H
30 LET D = 24 HR/DAY
35 LET Y = 365 DAY/YR
40 LET X = H*D
45 PRINT X
50 LET P = X*Y
55 PRINT P
60 END
```

Program for finding the % of population of Brockton by age:

0-19 years	33,913	
20-34 years	18,369	total = 89040
35-64 years	26,980	
65 and over	9,778	

```
 5 REM LET A BE PEOPLE 0-19 YRS.
10 LET A = 33,913
11 LET T = 89040
15 LET P = (A/T) * 100
20 PRINT "% OF" A "=" D
21 REM LET B BE PEOPLE 20-34 YRS
25 LET B = 18, 369
30 LET PI = (B/T) * 100
35 PRINT "% OF "B "= P1
36 REM LET C BE PEOPLE 35-64 YRS
40 LET C = 26,980
45 LET P2 = (C/T) * 100
50 PRINT % OF C = P2
51 REM LET D BE PEOPLE 65 AND OVER
55 LET D = 9,778
60 LET P3 = (D/T) * 100
65 PRINT % OF D = P3
70 END
```

Change to A = R * T and use READ, DATA statements

```
 5 LET A = R * T
10 READ R, T
15 PRINT A
20 EO to 5
25 DATA 5, 10, 2, 10, 3, 8, 3, 15
30 END
```

Briefly go over

Assignment: Write a simple program.
Read Chapter 2 in BASIC and do #1, 2.

Lesson V

Title: Flow-charting

Objectives: Given a flow chart of a program, the student will be able to select the correct program for it and with more practice, write a program from the information in a flow chart.

Given a problem to be solved on the computer, the student will first be able to organize the program into a flow chart.

Given the definitions and uses of conditional (IF...THEN) and unconditional (EO TO) statements, the student will use them in his drawing of a flow-chart.

Procedure: 1. Give definition of flow chart as on the transparency.

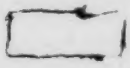
Go over the order in which you put on your shoes.

Deal with Pete Schmoe's problem - CAMP p. 14

2. Introduce conditional (IF...THEN) statements and unconditional statements (GO TO)
Also go over less than or equal to $\leq$
greater than or equal to $\geq$

3. Give the parts of a flow chart

START, STOP


ACTION

DECISION

PRINT - OUTPUT

FLOW OF DIRECTION

4. Go over flow charts and their programs.

5. Write a flow chart and program for a payroll.

LESSON VI and VII

Title: It Works!

Objectives: The student will be able to run his own programs.

The student will be able to correct his own programming errors while at the teletype.

Given his recorded program, the student will be able to receive the correct output from it.

Time: 4-5 mods

Materials: more data for programs

Procedure: Quickly review all statements and procedures. Go over their homework programs. Finally do some more programs together.

Assignment: Study.

Pitfalls:

1. Students are very anxious to play "games" with the computer; they think of it as more human - somewhat of a robot.
2. Many think all programs are the same. They don't understand that they are telling the computer what to tell them.
3. Not knowing how to type is a hindrance.
4. Not enough TTY's to get everyone to complete a program during a lab.
5. Because only four people are really working at a time, there can be much confusion and noise in the room. Next time must give them something to do while waiting.

MICRO GRAPHIC ANALYSIS

Science - Cycle IV

This cycle emphasizes macro-micro head-datum flowage perception and simple related land use implications associated with water supply, quality, and outdoor recreation factors. Impact is assessed by way of an elementary graphic-systems analysis program showing the multi dimensional a-biotic (saline) influences upon biotic organisms within the specific test area.

Summative Objectives:

1. The student will further develop his ability to see social geographic elements involved in analyzing micro water environmental problems.

2. The student will perceive the basic interfacings between the various socio-physiographical geographics within which he lives: i.e., family, neighborhood, SMSA, Basin, Regional physiographic province, etc.

3. The student should become more aware of the factors of land and regional land use, local and regional economics, concepts such as local and regional self-sufficiency, knowledge of the local skills and resource materials and the need to plan quantitatively as well as qualitatively for the production and distribution of regional goods and services.

4. The student will begin to see that his individual civic focus should not only be upon the macro scale but that much more emphasis upon micro quality is the key that can gradually but realistically lead to progress on the entire spatial spectrum.

Lesson I

Title: "Locus Focus"

This lesson provides an introduction to micro water environment modeling as well as further skill in study area delineation techniques. It also further develops a more sophisticated understanding of localized riparian engineering and planning concepts.

Time: 2-6 mods depending upon rate of learning and depth of detail desired

Objectives:

1. Provided with a set of graticule coordinates and an accompanying plan, the student will fix study sites with 90% accuracy.

2. Provided with a series of blank multi-scale hydrographic configurations, the student will identify 80% of the component nominals and flow sequences involved.

Materials: local and regional plans and maps and lots of chalk

Procedure:

Part A.

1. Explain regional to neighborhood water systems analysis concepts....discuss sampling procedures for this time of year and warn of related danger, etc.

2. Use 3D model to explain various ridge divide types. .....develop aerial "wits" and photos for aids in field rim perceptions....(planing out plus elevation consciousness).

3. Delineate numbers and names of the sub regions... establish southerly benchmark patterns (to zero).

4. Delineate discharge pattern and names (35 on half) after teaching upstream contours, script, and rebound theories.

Part B.

1. Discuss the U.N. system model for monitoring micro-time phenomena (vs. micro-locale phenomena).

2. Explain graticuling techniques.

3. Explain differences between two recorded events i.e., 71, 27, 14B by 42, 18, 23F

4. Relate A-I of graticule to sampling stations on Area B.

5. Describe the pandemic event-area conditions leading up to boundary B aquatic phenomena.

6. Assign sample gathering.

Further development: Much shoul i be done to facilitate slower learners grasp of this material.

Lesson II

Title: Site Analysis - A-biotic

Time: 2-6 mods per learning rate depth of study

Objectives:

1. Using the Hach kit the student will determine concentrations of Cu, Cr, Na-Cl, color, PH, turbidity, Mn, Fe, Si with 90% accuracy.

2. Provided with a list of statements describing transmission-absorbtion curves for various concentrations, the student will differentiate between correct and incorrect statements with 70% accuracy.

3. Given a set of hypothetical concentration values for a series of area water body types, the student will determine which examples meet Mass. standards and which don't with 80% accuracy.

4. Given prepared samples of nitrate and phosphate enriched water, the student will determine (with 80% accuracy) the ppm values of these nutrients in the water samples.

5. Will differentiate between correct and incorrect plankton microscopic and keying technique with 80% accuracy.

Materials: Hach, distilled water (2 gallons), clean glassware

Procedure:

1. Review dilution, buffering, use of distilled, mg/l, chemical abbreviation, wet chemical burette reading, rinsing, sample averaging and spectro vs. titrametric analysis principles. Covered in previous cycles: chloride and copper as vehicles.

2. Discuss ecological-legal and health-legal standards plus ecological and health non-legal criteria factors - enforcement bodies, etc.

3. List Cu, Cr, NA-CL, Color, PH, Mn, Fe, Si and upstream-downstream blocks on board.

4. Describe tally mechanism and notebook usage.

5. Assign sampling teams a parameter - average of three samples - then choose any other parameter.

6. Provide equipment.

7. Aid students in trouble.

8. Discuss 'phenomenal" vs base line implication.

9. Student's record on board.

Pitfalls: Considerable additional material should be developed for the rapid learners i.e.:
Advanced students move ahead to D.O., CO_2 etc. analysis...also assign readings re: significance in the water environment.

Iesson III

Title: Site Analysis - Biotic

Time: 2-6 mods

Materials: grid mikes, milli unit, well slides, cover slips, sample, eye droppers, plankton slides: 35 mm and fixed, slide projector, plankton plates and books, indicator sheets, lens paper, wash bottles and distilled H_2O, jar of growing plankton, diagram on regeneration, stains, Dept. of Health tally list, a supply of a few live uni-cultures.

Objectives:

1. Given an O_2 cycle without flow lines and key labels, the student will complete the diagrams and signify the plankton O_2 relationship.

2. Given the nutrient cycles with mgn components missing, the student will be able to complete the diagram and describe the importance of nutrients to all aquatic organisms.

3. Given various concentration values of nitrate and phosphate, the student will describe probable effects on algae growth.

4. When shown a water sample, the origin of which is known only to the teacher, the students will identify and tally the types of organismic growth present.

5. Given a diagram showing the exchange of gases and nutrients and energy associated with local fresh water and estuary planktons, the student will fill in the key missing parts of said diagram with 60% accuracy.

6. Provided with a description of the characteristics of a plankton, the student will recognize as an algae type and further delineate which algae type with 60% accuracy.

7. Provided with a fixed plankton slide set, the student will delineate structure, shape, color and opacity factors with 90% accuracy.

Procedure:

1. Describe the positive and negative aspects of the organism....delineate new interpretations of it as a pollutant....protein, food base, toxicity, turbidity.

2. Describe how organism type relates to latitudinal insolar energy and "available" ionic nutrients = indicators.

3. Teach how to tell "right-eyed" or left-eyedness".

4. Prepare for disappointment re: organism size... show idealized plates and discuss how real organism may be in a different position or a sub species, etc. - notate techniques of intensifying color by correct use of light and stains... stress low power to high sequence.

5. Clarify zoo vs phyto and why algae are the study group....discuss 80% role re: O_2 vs. leaves, etc....show several slides and classify into 4 main groups (see page 8 in plankton book) - on/off delivery mode.

6. Describe how to concentrate and the technique of making a good slide.

7. Hand out one fixed type and follow through key to conclusion as a group.

8. Show Health Tally list.

9. Students make ur own slides and use key to identify organisms and calculate diversity in sample A vs B. (B is Saline.)

10. Discuss the way to use a process of elimination and frequency tally in connection with the indicator list to get water quality implication.

11. Discuss ways to write a program which will distinguish prevailing indicator type and quality implications for shed B.

Further Development: more efficient teacher aids, uni-cultures, staining procedures, more fixed slides, simplify classification key

Pitfalls: A good system of cleanup of all materials should begin several minutes before end of lab.

Needs some simplification.

NOTE: Lab Test for this consists of at least a 20 minute I.D. exercise ideally.

Lesson IV

Title: Process and Program - Part I

Time: 2-8 mods

Materials - collected data - computer time?!

Objectives:

1. Student will flow chart study elements.
2. Students will organize collected data into their own program design....giving rationale for same.
3. Students will submit a 90% workable computer program involving all study elements which will print out useful answers to hypothetical problems related to the quality of the system.

Procedure:

1. Briefly review general areas covered by Cycle III in math-computer section.
2. Describe the F.W.P.C.A. Storet technique.
3. Discuss ways to apply Storet approach to our micro model...using our minimal data on a-biotics and biotics.
4. Students work in pairs during last half of period processing data recorded in previous lab....set up own flow chart...and write sample program.

Pitfalls: Difficult to get computer time to test programs for entire group.

Further Development: Be sure to provide an opportunity for rapid learners to get to a computer and produce indepth "ABC" programs... including macros.

needs further simplification of teacher

Lesson V

Lesson Title: Print out - graphics
Synthesis

Time: 2-8 mods

Materials: Collected data, plan specifications, usual graphics materials

Objectives:

1. The student will be able to organize his collected data in graphic-systemic form.

2. Provided with a set of similarly scaled configuration frames for a series of mono-planar elements contained within a specific boundary dealing with a group of related "ABC" parameters, the student will, from his knowledge of the real world system setting being studied sequentially build up said configurations into a composite ABC environment.

3. Students will be able to articulate findings.

Procedure:

1. Hand out the graphics materials and supplies used in Cycle I.

2. Briefly review essential areas in which conflicts are common, i.e. provide a localized map section and review how the study area breaks down into the various base parameters.

3. Students reconstruct the study area environment....including a symbol system delineating the analysis sites and related concentration values they recorded earlier in the lab exercises.

4. Students paste up above material on a poster... add the computerized data, and accompanying narrative and prepare selves to articulate findings before enforcing authorities and other concerned groups as well as other class members.

5. Students practice presenting this data....in small groups...to each other.

Pitfalls: Much need for creation of simpler devices related to system synthesis with "setting building".

This section is too rushed....too much material in too short a period.

SOCIAL PROBLEMS

in the

URBAN ENVIRONMENT

Social Science - Cycle V - Independent Research in Urban Social Problems

Summative Objective:

Working in groups, students will develop skills in self-directed learning of urban social problems.

Formative Objectives:

Given a list of problem areas related to problems in their urban environment, students will develop skills in planning an independent study program in one of these areas:

Students will acquire skills in

a. developing criteria for evaluating their own learning progress

b. defining the problem area for further study

c. identifying and cataloguing community and instructional resources that will be helpful in studying the problem area

d. organizing a presentation of their research to a group

Procedure: Class time was devoted to discussing the objectives of this unit - discussing criteria for evaluating learning, defining a problem, outlining a program, annotating bibliographies, identifying community and instructional resources, preparing an interview. Copies of handouts used during class discussion are enclosed.

Students were given the opportunity to do independent fieldwork in their area of research. Most students chose to conduct interviews with people in the community. Before going on an interview, they were required to prepare their questions and we discussed these and rewrote them if necessary.

Evaluation was conducted in two ways. Students evaluated their own work as a group and I evaluated the outline, bibliography and interview questions they prepared.

Comments: The enthusiasm generated by this opportunity to do independent work was almost overwhelming.

The only problems were related either to (1) the time limitations imposed on groups, (2) lack of information in certain areas, (3) group dynamics. I would suggest that this unit be repeated although it may be best to make this Unit VI - just preceding the actual time when independent study begins. Having an idea in advance as to what areas students are interested in should make the last few weeks of independent study more valuable, since the staff can be more effective as resource persons. The inability of some groups to function well could perhaps be eased by spending some time on group dynamics concepts. Regarding lack of information -- this proved a problem because students' research was oriented so closely to Brockton. If the IRC's could work out some way of cataloging the agencies in the city and samples of their work, this would help also. The students have volunteered information they collect to be kept on file for other students' use, and this will be available in the QUEST office next year.

handout used to discuss criteria
for self-evaluation

Criteria for Evaluation

1.	Responsibility in Group Assignments	Unreliable				Assumes Much Responsibility
		1	2	3	4	5
2.	Co-operation with Others in Group	Unco-operative				Generous Co-operative
3.	Contribution to Group Decision-Making	Obstructed Decisions				Facilitated Decisions
4.	Inititative in Pursuing Assignmert	Little or None			Took Great Initiative	
5.	Industry and Persistence	Did Little Work				Worked Steadily
6.	Amount of Relative Effort	Below Average		Average		Above Average
7.	Seriousness of Purpose	Purposeless				Purposeful Tried best
8.	Overall Academic Achievement	Failed to Meet Any Objectives				Met All Objectives

handout suggesting form for outlining independent project

QUEST SOCIAL SCIENCE

A. Statement of the problem you are researching.
For example: What are the differences between students educated in open classrooms and students educated in traditional settings?

B. Description of the areas involved in your research.
For example
1. Comparison of open and traditional classrooms.
   a. physical appearance
   b. role of teacher
   c. role of student
   d. types of activities
   e. philosophy behind methods

2. Comparison of students.
   a. attitudes toward schooling
   b. behavior; self-discipline
   c. ability for self-direction in learning

C. Statement of your conclusions or evaluations.
For example: Your personal evaluation of these types of learning--which do you prefer and why? Your suggestions for change in your own learning situation.

D. Ideas for further development:
Areas you haven't had time to look into but which would add to your own understanding of problem.

E. List of annotated instructional resources.
List of community resources and interview questions.

F. Ideas for presenting what you've learned to the class.
For example:
1. Discussion--include questions for discussion: background reading
2. Lecture--describe what audio-visual aids you'd use; include outline of lecture
3. Slidetape--describe narrative; outline pictures
4. Fieldtrip--where, who to contact, objectives for class--what they should learn from trip.
5. Role-playing game--describe situation and roles of main characters.

Also: At end of cycle, include your evaluation of your work and the work of your group. Give me a grade, and the reasons for that grade.

sample of permission slip used in fieldwork

QUEST FIELDWORK FORM

_____ has my permission to do fieldwork related to independent study in Project QUEST. I am aware that she/he will be going to _____ on _____ for the purpose of _____ _____ mods _____

_____ parent's signature

_____ teacher

_____ teacher

_____ teacher

_____ teacher

_____ teacher

_____ teacher

_____ teacher

_____ teacher

MORE PROGRAMMING

Math - Cycle V - More Programming

Summative Objectives:

1. After having completed this unit, the student will be able to write his own program dealing with variables.

2. The student will be able to realize and justify the use of the computer when dealing with environmental problems.

Formative Objectives:

1. The student will recall previous information learned in Cycle IV as to legal characters, the uses of command statements and flow charting.

2. Given information and the flow charts for 3 out of 5 programs, the student will write 2 programs, one unit with the help of a flow chart and one without, using the command statements READ, DATA, LET, PRINT, END, EOTO.

3. Using the programs the students wrote the previous day, they will punch their own programs into the computer and receive the correct output.

4. The student will alter the modes in which he receives his output by learning and utilizing the special uses of the PRINT statement and zones.

5. The student will submit data in a program using an INPUT statement.

6. The student will utilize the BUILT-IN functions SQR, ABS, RND, SIN, COS, TAS.

6a. The student will learn how to make copies from his program LIST, how to get rid of a line in his program DELETE, and how to halt a program S.

7. The student will recall the use of flow charting and use it in explaining decision-making on the computer's part.

8. The student will differentiate between conditional and unconditional statements.

9. The student will utilize the IF...THEN statement more frequently.

10. The student will write programs in BASIC language to solve environmental problems.

11. Given the data, the student will write and run a program concerning the environment in Brockton.

12. The student will type his program finding the mean of numbers.

13. The student will correct errors while at the teletype.

Math - Cycle V

Lesson I

Title: Review of Unit IV

Objectives: The student will recall previous information learned in Unit IV as to legal characters, the uses of command statements and flow charting.

Time: 2 mods

Materials: overhead, transparencies, review sheet

Procedure: Start off by going over every overhead with the class concerning:

1. computer's machinery
2. legal and illegal characters
3. command statements
4. flowcharting
5. drill examples

Make sure they realize that every program is not written the same.

Start in class together the following review sheet.

Assignment: If tomorrow is not a lab day then read pg. 31-33 and do pg. 36, #4,5.

If the next day is a lab day, write a program to find the mean of some numbers.

Lesson II: if it is not a lab day

Title: Writing Programs

Objectives: Given the data, the student will write and run (tomorrow) a program concerning the environment of Brockton.

Given the information and the flow charts for 3 out of 5 programs, the student will write 2 programs, one with the help of a flow chart and one without, using the command statements READ, DATA, LET, PRINT, END, GO TO.

Time: 2 mods

Materials: overhead, transparencies

Procedure: Start by going over review sheet and homework. Introduce amount of rainfall program. Then put the two following problems on the board. Show the students the flow chart for the pool program. Have them write the program.

Next introduce these two problems:

1. Find the % of people by ages living in Brockton.

0-19	33913
20-34	18369
35-64	26980
65+	9778

2. If the population of Brockton increases by 2.25% by 1980, what will be the population then?

population in 1970 89040

Show them the increase in population flow chart and have them write it.

Finish the remaining two for homework.

Assignment: Finish writing programs.

Lesson III: if it is a lab day

Title: Punching out Brockton's Problems

Objectives: Using the programs the students wrote the previous day, they will punch their own programs into the computer and receive the correct output.

The student will correct his errors while at the teletype.

Time: 3 mods

Materials: teletypes, programs the students wrote yesterday

Procedure: Students will type out their programs.

Assignment: none

Lesson IV:

Title: More Instructions

Objectives: The student will alter the mode in which he rec... his output by learning and utilizing the speci... uses of the PRINT statement and zones.

The student will submit data in a program using ... INPUT statement.

The student will utilize the BUILT-IN function... SQR, ABS, RND, SIN, COS, TAN.

The student will learn how to make copies from h... program LIST, how to get rid of a line in his prgram DELETE, and how to halt a program S.

Time: 2 mods

Materials: overhead, transparencies, BASIC, program

Procedure: Work with the overheads dealing with

1. BASIC functions
2. BUILT IN functions
3. LIST, DELETE
4. SCRATCH, RUN, S
5. 2 on INPUT statement
6. 4 on PRINT statement

Go over each one step by step, reviewing each drill problem.

Work on tonight's assignment program.

Assignment: p. 33-36 in BASIC #1,2,3.
If tomorrow is a lab day do program on the standards for coliform counts in classifying water.

Lesson V: if not a lab day

Title: IF...THEN

Objectives: The student will recall the use of flow charting and use it in explaining decision-making on the computer's part.

The student will differentiate between conditional and unconditional statements.

The student will utilize the IF...THEN statement more fluently.

Time: 2 mods

Materials: overhead, transparencies, program

Procedure: Go over homework.

Review the overheads on

1. comparison
2. 2 if's
3. loops
4. program

Review flow charting.

Conditional - IF...THEN decision making

Unconditional - GO TO

Start program together.

Assignment: page 25 in BASIC #1,2

program

study for quiz

LESSON VI: if a lab day

Title: Running Programs

Objectives: Using the programs the students wrote, they will punch their own programs into the computer and receive the correct output.

The student will correct his errors while at the teletype.

Time: 3 mods

Materials: programs on coliform classification and pH classification

Procedure: Students will type out their programs.

Leave one mod for taking quiz.

Assignment: none

MAN AND HYDRAULICS IN THE LOCAL AND REGIONAL ENVIRONMENT

Science - Cycle V - Man and Hydraulics in the Local and Regional Environment

Summative Objective:

1. The student will become skilled and knowledgeable in the area of using basic hydrological equipment and understanding the essentials of micro climatic input into the local hydrological system; volume patterns and natural and man-made processes occurring within this system and the human aspect relative to managing and planning for the use and distribution of water resources.

2. The student will further develop his ability to independently research all aspects of the water environment.

Lesson I

Title: Water Availability Perspectives

Time: 2-4 mods

Materials: slide rules, calculators if available, CBS Video "Water Famine (Part A - 10 minutes)

Objectives:

1. Provided with a list of areas of local environmental concern, and asked to order them according to importance, the student will rank environmental problems related to either too much or too little water among the upper 50%ile.

2. The student will be able to calculate basic hydro-meteorological values for local and regional areas.

3. The student will be able to construct hydrological input-output programs.

Procedures:

1. Recapitulate coverage of quality to date. Categorize sub components of supply category as meteorological, surficial reservoir, ground and outdoor recreation.

2. Diagram NEWS population growth curve vs. water resource usage curve on board.

3. Reinforce systems approach... 'new earth' philosophies, etc...what man has changed man can change, etc...computer as a tool. Discuss dark ages to renaissance corrolary and our eschatological position re: above. Stress disposable architecture concept and cite urban renewal areas.

4. Ask the question: Is there a shortage of water?

5. Define CFS, MGC, RF, and other fundamental meteorological and hydraulic terms.

6. Discuss local P-PE and P storage as these factors relate to our micro global position per Koeppen.

7. Hand out slide rules and using above information have students compute mean quantity of water available for our hydrological region.

8. Students construct a program for solving above.

9. Show Part I 20 min. C.B.S. documentary: 'Water Famine'.

   Discuss above film in remaining time.... stressing the fact that science has the knowledge of how to solve water conflicts but man's autonomous and broad collective political approaches reflect man's inability to get along with his neighbor as well as man's ignorance of naturally intrinsic distribution system implications.

10. Discuss need for man to find ways to convert naturally intrinsic implications into social-political realities.

Further Development

-Simplification of math for slower students.
-Better audio visual aids.

Pitfalls: Do not assume all students can make calculations with the slide rule.

Lesson II

Title: Impacts of Natural Anamolies

Time: 4-8 mods

Materials: Transit levels, B.H.S. plans, Petot tubes, stop watches, meter sticks, bucket

Objectives:

1. The student will be able to calculate the amount of lateral expansion potential for given points along a thaleweg.

2. The student will recall the names of, and how to use, hydrological analysis equipment.

3. The student will be able to read, with understanding, the sections of local engineering and planning documents which deal with hydrological matters.

4. The student will rank the water shortage amongst his choice of the 10 most serious environmental problems facing his community.

5. The student will recall basic local and regional hydrological essentia.

Procedures:

1. Discuss the storms of record for our area and their local and regional impacts - 3,44,62,69, etc.

2. Discuss Agnes - (filmstrip) and Guiness records re global scale.

3. Discuss urban impact curve trends vs. non-urban.

4. Describe calculated risk re: 5-10-20-50 year types. re: various prone areas in locality. (designate areas)

5. Show Salisbury plain areas and depth - structure - contents calculations plus high school site areas and related contours.

6. Review history of site determination at high school.

7. Begin evaluation of hydrographic types vs. building site flooding frequencies.

8. Explain method of evaluation of site stream lateral flow in terms of collection area inputs, and discharge (CFS output) pattern of topographical influence.

9. Explain how similar hydrographic types tend to produce greater and greater damage over time -- and relationship to the complete definition of the term: flood.

10. Calculate CFS on inside lab model...stressing lack of shed....show W meadow shed....discuss ways of determining size: $\frac{x}{530} = \frac{4}{850}$

11. Calculate CFS on outside "real world' model ...noting sloping contours, flowage though clear, uniqueness of discharge point, speed of surface discharge vs isopach flow, height at rim that equates 121' (transit) etc.

12. Using calculator and various hydrographics determine flooding frequencies and related impacts.

13. Show Salisbury renewal design - relate to disposable building age, etc.

14. Describe drought of 56.

15. Provide 15 minutes to read CDM description of problems and recommendations at Field Park....point out how they are unique in being able to understand this document.

16. Calculate the value of the water in flag brook and in Silver Lake shed - describe well nature of Silver lake, calculate value of water at Avon Reservoir....include energy re: X.S. profile.

Further development:

Create in-depth work for faster learners.

Pitfalls: General low math aptitude of many students.

Many students seem to have forgotten programming techniques which were learned earlier.

Lesson III

Title: "Odds and Ends" + Conclusion of Unit

This lesson is designed to not only bring the study of the water environment to a conclusion but also to provide the student with a basic awareness of several other significant water related problems that were not covered due to the time factor.

Part A, dealing with erosion, is designed to act as a transitional focus between this unit and the next unit dealing with the land and soil environment.

Time: 3-7 mods

Part A:

Materials: Petot meters, stopwatches, .40 filters, filter base and support holder, seine, hip boots, transits, micro gram balances, etc.

Objectives:

1. Provided with a micro gram balance and accompanying weights, the student will calebrate the instrument in preparation for .1 to 1 mg. range.

2. Provided with the necessary equipment, the student will obtain a sample of the stream load sediment being carried by a local river and calculate the total amount and cost of erosion for the study area.

3. The student will be able to define such terms as physiographics, 'locology", sociography, etc.

Procedures:

1. Ask class what other important areas of water environment concern they can think of that we have not studied.

2. Review, with class, the major aspects of the following water environment problems and topics: Outdoor water recreation; Hydro electric generation; Politics of basin planning and management; Erosion, etc.

3. Explain to class that since the next unit is concerned with the land and soil environment that we will now explore as a last topic under the water environment and sort of the first topic under the land and soil environment, the problem of local and regional erosion.

4. Demonstrate technique of calibrating balances in preparation for a micro gravimetric analysis.

5. Demonstrate method of acquiring a weighable sample of stream load sediment.

6. Demonstrate technique of calculating the eutrophication rates for micro to macro basin estuariane deltas.

7. Discuss the futility of working from the discharge point back upstream to solve the problem. (considering energy costs)

8. Discuss damage to shellfish industry from sedimentation.

9. Discuss the long range social economic advantages of short range social economic soil erosion control costs.

Further Development:

Create more simple techniques of acquiring needed mathematical values.

Pitfalls: Math aptitude may be below the levels required to <u>independently</u> solve the above eutrophication problem.

<u>Part B</u>:

The teacher should bring this lesson to a close by noting that although there are several areas of the water environment that were not covered in great depth, the student has nevertheless been taken through an exposure to concepts that should greatly improve his ability to better understand many aspects of our total environmental condition.

It should also be pointed out to the student that from the initial introduction to environmental systems physio-sociographic general study was made locological...and that all of his analytical work, though focused upon one parameter, was designed to apply generally to all systems at all scales.... and finally that he might, hopefully, have developed new image pattern models of the "ideal" total environment that will stand him in good stead as he is called upon to participate as a citizen (or otherwise) in local to global environmental system managements decisions.

ENVIRONMENTAL LAW

Social Science - Cycle VI

Environmental Law

Lesson I: Introduction to legal history re: environment.

Objectives: Students will discuss the origin of the citizen's right to preserve environmental litigation: mandamus, administrative procedures act, 10-citizen action suit, environmental bill of rights.

Students will discuss the origin of governments' power to control environmental pollution. This power arises from the police power and public nuisance theory.

Materials: chalkboard, chalk, overheads

Procedure: 1. Explain the structure of the unit first -- in this section a special assignment is required of those students taking QUEST for honors or advanced credit. Extra credit will be given to those students in standard level for assignment. Because the topic of environmental law is a complex and involved area, the lecture material is really just a framework for understanding the field. The special assignment permits students to enrich their background through additional reading into an area of environmental law or politics of interest to them. Whenever possible during the cycle, class time should be given to encourage students to work on the assignment. Some suggested topic areas are

(A) The History of the Conservation Movement in America

The "Ecology Movement" is not wholly unprecedented in our history, although the times when conservation was a policy concern seem to fall within the Progressive Era of Theodore Roosevelt, the New Deal Era of Franklin Roosevelt, and the decades of the 1960's and 1970's.

(See background materials for further information.) This history could perhaps be developed into another lesson.

B. Case Studies of Environmental Controversy

For example: SST, Mineral King, Calvert Cliffs, off shore drilling, strip mining, energy crisis legislation, Pilgrim Power Plant (historically - Muer vs. Pinchot over use of federal land; TVA).

(See background materials for references.)

C. Case Studies of Environmental Agencies:

(EPA, Army Corps of Engineers, State Department of Natural Resources, local Conservation Commissions, Sierra Club, Audubon Society, Z.P.G., Environmental Defense League, etc.

D. Book reports:

The Politics of Pollution: J. Clarence Davies

The Closing Circle: Barry Commoner

The Environmental Handbook: ed. by Garrett deBell

C.E.Q. Environmental Quality Reports 1970, 1971, 1972, 1973, etc.

Students have recommended 10 days to complete special assignments.

2. Begin to question the origin of rights and responsibilities toward the environment in our society.

Questions: A. Do people have right to pollute the environment?

Why not?

B. Where does our right to a clean, healthful and enjoyable environment come from?

C. Where does government get the right to control the quality of our national, state and local environment?

Answers:

A. No. Pollution interferes with the health, safety and welfare of the general public and with the right of the public to use and enjoy the natural resources of our country.

B. There is no federal document which specifies that the people of the United States have environmental rights. (There is an amendment to the Mass. state constitution, however, which does.) The Preamble of the Constitution (overhead) can be interpreted in this way. Although there was no pollution then as we know it today, the intent (or "spirit of the law") of our society is to protect the general welfare and preserve the wealth of our land for posterity. In recent years the courts and many state legislatures as well have articulated their rights.

C. The common law theory (common law is based on tradition - not written law. American common law theory originates from British precedents, many of which were based on Roman and Greek laws promulgated centuries ago) of public nuisance declared the government had the responsibility to deal with anything which interfered with use and enjoyment of public right. The concept of pollution was unknown in the past time in which our common law developed, but it fit nicely into the concept of public nuisance. The authority to legislate to protect the general health and welfare is the police power of government, a power societies have long acceded to their governments. Pollution control is the natural domain of the government, particularly when such large economic interests are involved. It is true that economic interests are a powerful influence in governmental decision-making, often to the detriment of the environment. But the limitations of the legal options available to citizens to control pollution, make effective large-scale citizen enforcement impossible. The role of citizens becomes one of making the government respond effectively to the public's demand for a healthful and enjoyable environment.

3. Explain that there are some important pieces of State legislation that we should stop to consider. As citizens of Mass. we have environmental rights and legal means of enforcement not available to citizens of many other states. Using overheads, outline the impact of

   A. 10-citizen action suit

   B. environmental bill of rights

   C. mandamus suit

Lesson II

Title: Recent Environmental Legislation

Objectives: Students will assess the impact of the NEPA.

Students will examine the structure and function of the Council of Environmental Quality, and the Environmental Protection Agency.

Materials: folder in NEPA
EPA

Procedure: Explain that most environmental legislation has been enacted by Congress and state legislatures within the past 10 years. Prior to 1964 the field of "environmental law" was non-existent; even today few lawyers are knowledgeable about the use of laws dealing with the environment.

Enforcement: A. On the federal level, one of the laws that has had the greatest impact is the National Environmental Policy Act.

Use overheads and sample impact statements in folder to outline the main impact of the law.

B. Other laws have been enacted to deal specifically with different environmental problems - air pollution, water pollution, pesticide pollution, solid waste, etc. You have discussed the Water Pollution Control Act in the science section. That act, as well as the other pollution control laws are only as effective as the agencies which enforce them. The Environmental Protection Agency was organized in 1971 to accomplish this. Also note that the NOAA - National Oceanic and Atmospheric Administration - was established to deal with international and long-term problems of our oceans and atmosphere.

(See folder on EPA.)

Lesson III

Title: State Environmental Law

Objectives: Students will examine the structure and function of the Department of Natural Resources and local Conservation Commissions.

Students will discuss Massachusetts Inland Wetlands Protection Act, Flood plain Zoning and the Massachusetts Environmental Policy Act.

Materials:

folders
DNR and proposed Reorganization Plans
Conservation Commissions
Inland Wetlands Acts
Flood plain zoning
MEPA

Procedure: . Using the materials contained in the folders as background, explain (a) the structure of state environmental agencies (DNR, Conservation Commissions)

b. the advantages of reorganization of state agencies into Department of Environmental Affairs

c. the intent and impact of the Wetlands Act

d. the use of flood plain zoning

e. the intent of the Mass. Environmental Protection Act

Some time should be spent on discussing the question of governmental land use regulations - how does this impinge on rights of property owners. Discuss the "taking" issue as an example of a critical legal issue.

References on the taking issue can be found in Chapter IV of the CEQ 1973 Environmental Quality Report and in the symposium outline Battle for Land (p. 20A-B) available from New England Law Institute, Six Beacon Street, Room 500, Boston, Mass. 02108.

Lesson IV:

Title: Environmental Action Through Legislative Process

Objectives: Students will become familiar with tactics of environmental lobbying in a legislative procedure through examination of the process at state or local levels.

Materials: folder on legislative process:
"Mass. Forest & Park Association"
'How a Bill Becomes a Law"
"League of Environmental Voters'
Sample bills and legislative records
Case study of MEPA amendment
Handout on Brockton's representatives

Procedure: A. Discuss the nature of the state legislative procedure - emphasizing the points of public input:

1. open filing procedure

2. open hearings before committee

3. opportunities for lobbying with legislators in session. Explain function of lobbyists - and discuss role of such environmental groups as Mass. Forest & Park Association which is a professional, private, environmental lobby, and the League of Conservation Voters which is a watch dog agency over legislators voting records on environmental legislation.

B. Use the legislative attempts to modify the Mass. Environmental Policy Act as an example of the importance of citizen intervention in legislative proceedings. The history of the MEPA is outlined in designated folders and on pp 153A-174 in the symposium outline BATTLE FOR THE LAND

Ideas for further development:

Plan field trip to State House - preferably on a day of a public hearing on environmental legislation.

Assign special credit to students who attend and comment upon a City Council meeting or Planning Board, Conservation Commission meeting, etc.

Begin a project of publicizing an important Bill within the school and community - perhaps organize a letter-writing campaign. Suggested bills for 1974-1975 legislative sessions would be "Bottle Bills - see folder for information.

MORE AND MORE

AND MORE PROGRAMMING

Math - Cycle VI

Lesson I

Title: Review of Units IV and V

Objectives: After a brief review, the student will recall the use of the command statements, special functions, and the uses of the computer.

Time: 2 mods

Procedure: Go over the Unit V test together. Then start by reviewing the overheads from Units IV and V - legal characters, what the command statements mean and how to use them, systems commands, built-in functions, etc. Go over problems on the overheads.

Now start on writing the programs for the classification of water by coliform count. Instead of writing it for them, outline a flow chart for them.

Materials: Overheads of Units IV and V, Unit V test, programs on classification of water based on coliform count.

Assignment: Finish writing two programs on the classification of water.

Lesson II: if a lab day

Title: Programs on Classifying Water by Coliform Count

Objectives: The student will write programs dealing with coliform counts, flooding of Flagg's Pond and damage to structures due to flooding, and city budget.

The student will run the programs they wrote, correct their mistakes and receive the correct output.

Procedure: Draw flow chart on board for 1 of 2 programs on coliform counts. Have students write and run 2 programs.

Time: 3 mods

Materials: programs on Coliform Count, review sheet

Assignment: review sheet

Lesson III

Title: IF...THEN

Objective: The student will learn and utilize the special uses of the IF...THEN statement

Time: 2 mods

Materials: overhead, transparencies, program on pH level of iron, BASIC book

Procedure: Show the transparencies on comparisons, typed program and output, Linda's grade program, two overheads on loops from PROGRAMMING book.

In class together, write a program:

1. listing the multiples of 2 that are less than 15
2. listing the multiples of 6 beginning with 18 and ending with 60
3. printing the pairs of numbers A, B so that their sum is 35
4. listing the multiples of 3 between 15 and 46
5. listing a) multiples of 2 less than 19
   b) multiples of 3 less than 39
   c) multiples of 7 less than 73
   d) multiples of 5 less than 125

Have them do these in groups

Assignment: Read Chapter 3 in BASIC, page 25, #1,2.

Lesson IV

Title: FOR...NEXT

Objectives: The student will use the FOR...NEXT loop when writing his programs.

Time: 2 mods

Materials: overhead, transparencies, programs or flooding Flagg's pond, damage to structure due to flooding

Procedure: Go over homework if there was any assigned.

Show overheads or characterisitcs of loops, LOOPING, 2 examples of FOR...NEXT, typed example of FOR...NEXT and overhead, flow charting of FOR... NEXT

Do together in class the programs on:

1. flooding Flagg's pond

2. damage done to a structure due to flooding

Assignment: Chapter 5 in BASIC book, pages 44-45, #1-4. Study for quiz.

Lesson V: If a lab day, take the first or last mod for a quiz.

If a day after a lab day, repeat day 4 without writing the programs together and then last mod give quiz.

Title: City Budget

Objective: The student will write programs dealing with coliform counts, flooding of Flagg's pond, damage to structures due to flooding and the city budget.

Time: 2 mods

Materials: overhead, transparency of city budget, and problem for programming

Assignment: None

Procedure: Work out the program dealing with the additional costs of 100, 200, 300, 400, 500 or 600 apartment dwellings based on the city's budget.

Leave the last mod for the quiz.

THE LAND AND SOIL ENVIRONMENT

"ALL LAND IS NOT EQUAL"

Science - Cycle VI

Lesson I

Title: Introduction to the land and soil environment

Time: 2-8 mods

Material and Supplies: soil corer, soil core, film strip on glacers and loop on facies, shovel

Objectives:

1. Provided with a series of land-soil definitions and a number of matched and unmatched terms relative to said definitions, the student will be able to discern the correct term-definition sets.

2. The student will become conscious of the fact that broadening his spatial awareness to include the sub-stratum zone greatly enhances his ability to perceive the "total environment".

Procedures:

1. Provide students with vocabulary words related to this section - assign research on those not covered throughout this lesson.

2. Describe planar and sub-planar graphics domain of material being. Remind students of how we studied the specific water system in terms of how it should function and that we will do the same here after we learn to soil orienteer' re: strata, facies, substance, etc.

3. Discuss evidence of the extraordinary disinterest and lack of awareness of manhattanized America regarding the significance of the planar-sub planar zone as it relates to providing human resource needs as well as providing objective engineering criteria for designing humane urban environments.

4. Clarify perspectives by focusing on food and mineral source and distribution aspects. (Meadows statistics and McHarg's engineering principles, etc.)

5. Discuss the significance of land and soil resources as they relate to past and present (future?) regional, national and international politics and political conflicts.

6. Introduce the questions: What is soil? Where did it come from?

7. Discuss the 'top to bottom" - bottom to top" options for discovery and orienteering inquiry and analysis.

8. Demonstrate the coring....elucidate types of zones....delineate junctions.

9. Show "Tragedy of the Commons" - discuss.

Pitfalls:

1. Very time-consuming material.

2. Need to define terms very slowly and precisely.

Lesson II

Title: Super imposition to insitu profile development

Time: 2-8 mods

Materials: ESCP film on glaciers and loop on facies, shovel, blow pipe, bedrock samples, stream table and ice block

Objectives:

1. The student will become more knowledgeable of significant local land and water processes and interactions over a total time perspective.

2. The student will become more conscious of unique local and regional land-man and soil interfacings.

Procedures:

Part A

1. Introduce class to local and regional physical geology.

2. Review four surficial modifications (pre humus).

3. Outline local evidence for glaciers plus the related landscape modification elements.

4. Discuss the consistency relationship of continental climatics and hydraulics in producing and modifying basic parent material types ....discuss post glacial global type variations vs. site variations relative to macro and micro climatic, time, gradient influences...i.e., forest, desert, woodland vs. DfA vs. Agawam, etc.

   (Clearly delineate humus-plus-parental and youthful parental stages.)

5. Describe formation of Long Island and South East New England landscape....precession, of inclination and ice ages, fluvial and sedimental characteristics.

6. Demonstrate glacial carving via ice block and stream table....recall near glacial state at Tuckerman's Ravine, ice flow under pressure concept, etc.

7. Describe A00, A01, etc. materials...Tuff-litter, etc. - 28 layers of A-B, C, and D.

Part B

1. Hand out soil collection bags.
2. Take students to three sampling sites.
3. Describe glacial and post glacial processes which have been involved in developing soil from each strata at each site - collect samples
4. Return to lab and analyze samples for PH.
5. Tally relative size, color, particle shapes via stereo optic.
6. Hypothesize reasons for variations, etc.

Further Development:

1. Develop regional and local slides re Strahler diagrams.
2. Develop the concept of locaglobological "zooming" re: engineering and planning of the human and physical environment.

Lesson III

Title: Engineering and Development Inequalities

Time: 3-7 mods

Materials: All soil Chemical and Physical analysis materials

Objectives:

1. The student will become aware of fundamental engineering and ecological soil criteria.
2. The student will perform basic chemical and physical analysis of engineering aspects of the land-soil environment.
3. The student will become more aware of the importance of the sub-strata in determining healthy, safe, economical and aesthetic surface use patterns.

Procedures:

Part A

1. Describe McHarg intrinsic suitability theory.
2. Discuss facies changes along route 24, etc.
3. Discuss Boston and Brockton "expanding pie" growth pattern vs. Paris and London "cell cluster" patterns, etc.
4. Stress 80% on 5% of land concept and our myopia due to 3500/sq. mi. here.
5. Remind class that changes below surface may not align with facies changes at surface
   i.e.: (A B C D
   (A B D F
6. Show McHarg Theories, Columbia, Reston, etc. - show "Multiply and Subdue the Earth" - discuss the whole concept of the role of soil in the attempt to design with nature.
7. Discuss objective engineering implications re: high school site:
   show strata samples
   recount historical conflict
   take engineers' scales and measure offsets in yellow entrance and blocks at yellow core interfaces
   show area bedrock samples and discuss compression values - piers, etc.

8. Show a series of slides on building damage attributable to poor site sub surface materials.

Part B

1. Discuss home site intrinsics.
2. Outline function of particle size to permeability and supportive capability.
3. Describe nine classes and "triangular" plotting thereof.
4. Analyze samples of home - site soils.

Part C

1. Describe unified system of soil classification.
2. Describe techniques of evaluating archeological factors.
3. Describe humus analysis techniques.

Pitfall: Far too much material to cover in such a short time span.